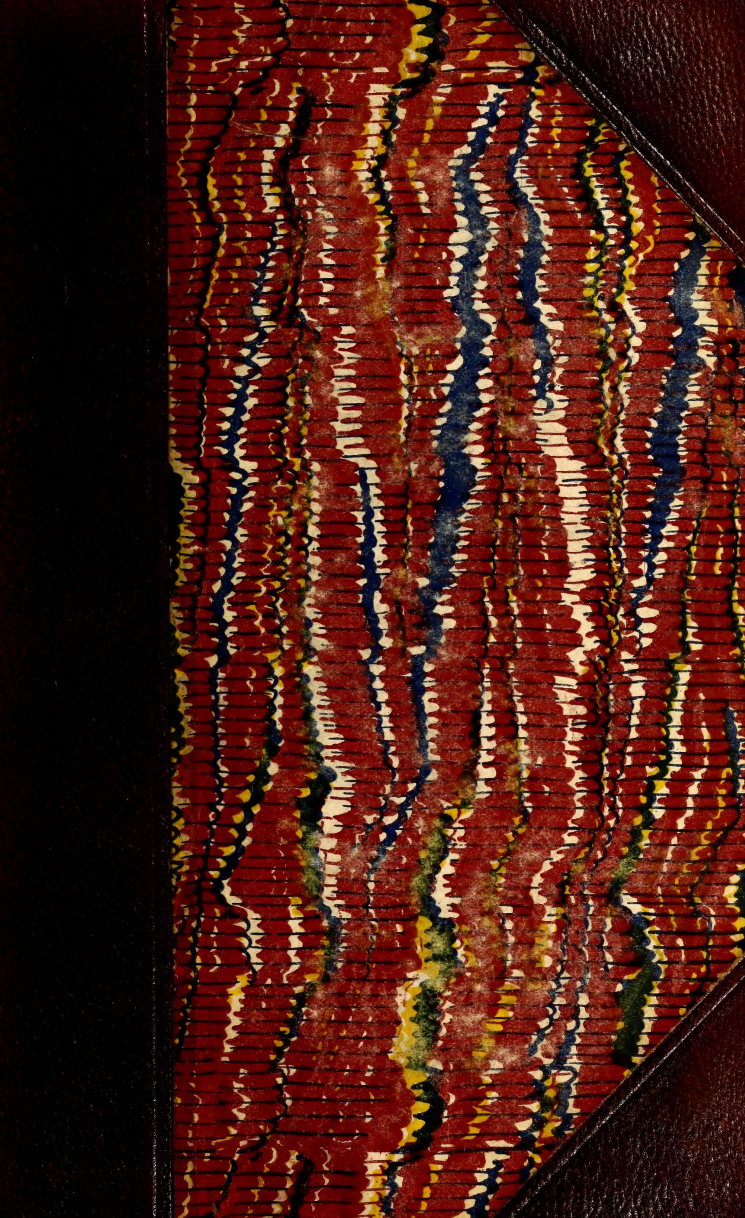


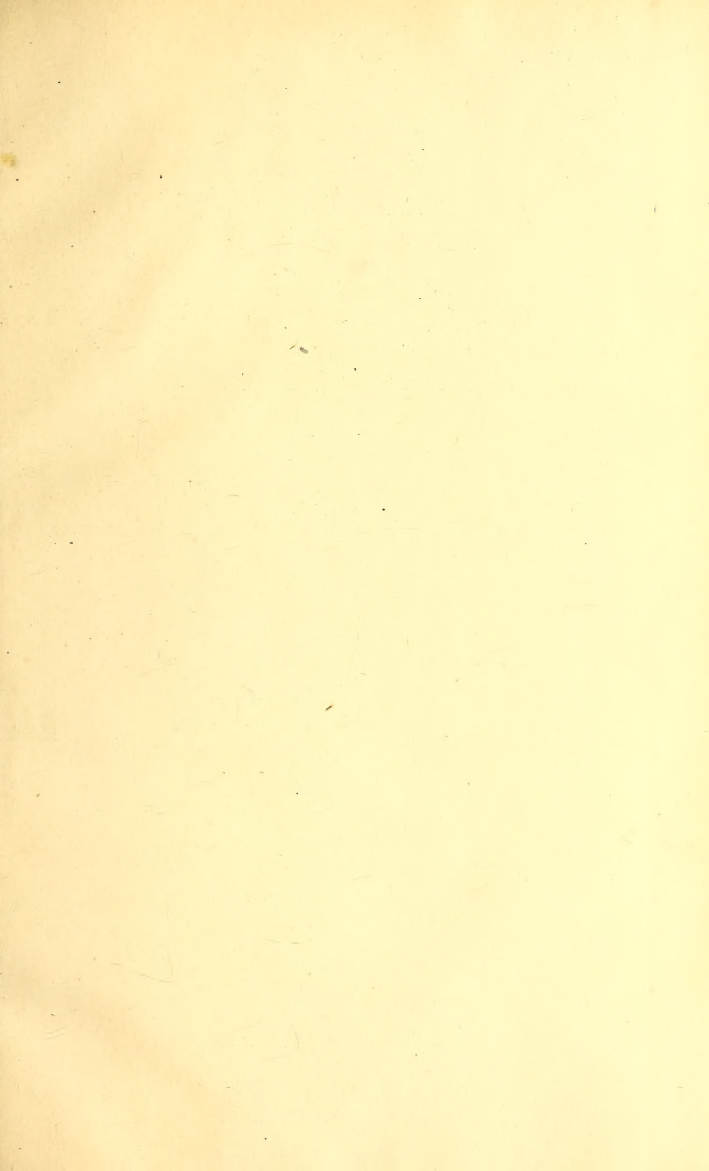


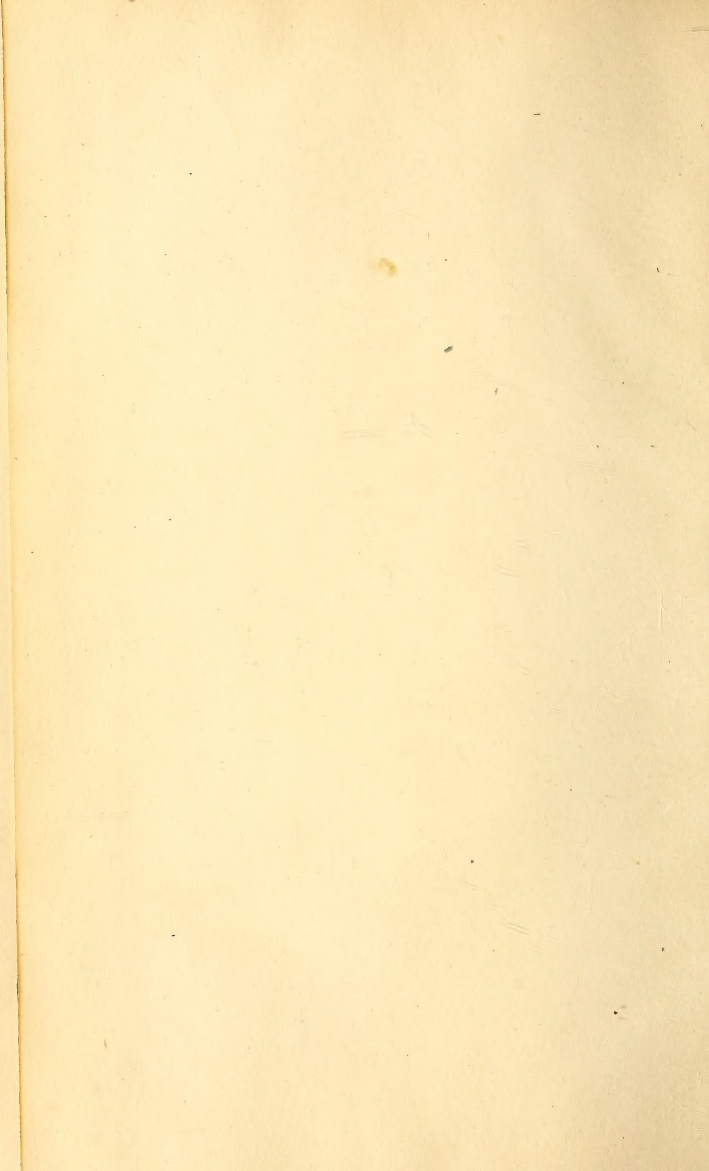


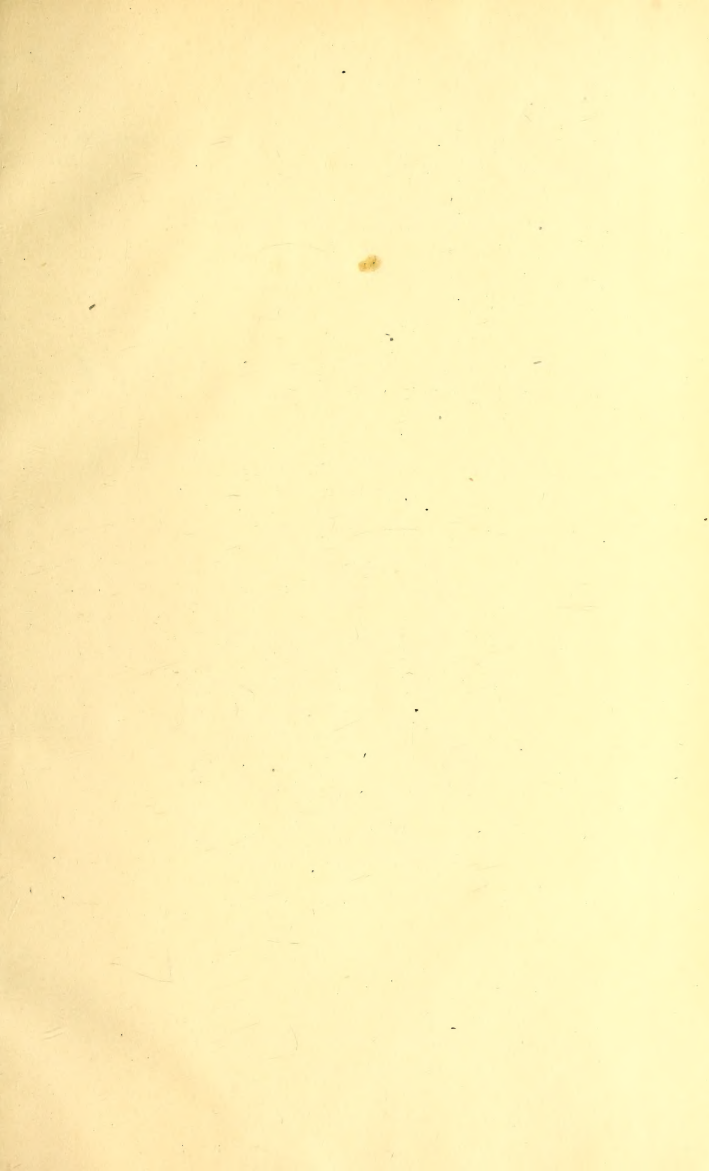
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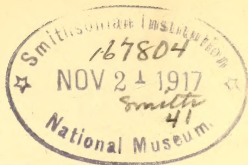








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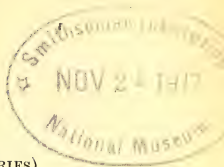
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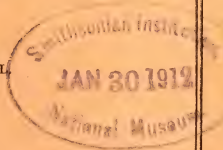
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In Memoriam.

JOHN BEDDOE, M.D., LL.D., EDIN., F.R.S., F.R.C.P., LON.,
Honorary Professor of Anthropology in the University of Bristol, Officier de l'Instruction Publique (1^{re} Classe), France, formerly President of the Royal Anthropological Institute, and of the Wiltshire Archæological and Natural History Society, Associate of the Anthropological Society Paris, and Corresponding Member of the Anthropological Societies of Berlin, Sweden, and Rome; Honorary Member of the Anthropological Societies of Brussels, Washington, and of the Bristol Naturalists' Society, Consulting Physician to the Children's Hospital and to the Dispensary, Bristol, &c.

In Dr. Beddoe we have lost not only a thinker and worker of European reputation, but a man whose kindly and lovable character endeared him to all who had the privilege of knowing him personally. Though he always looked frail he retained to the last his mental and physical energy, and only a few days before his death, on July 19th, he assisted in showing the antiquities of Bradford to a party of visitors.

As we learn from his *Memories of Eighty Years*, he was born at Bewdley, on September 21st, 1826, in a district where there are several families named Beddoe, Beddoes, and Beddows, all probably derived from the same Welsh Tribe, the Fifth, in Radnorshire. Dr. Thomas Beddoes, the chemist, a century earlier came from the same locality.

From infancy Dr. Beddoe had more than an ordinary share of ill-health. He broke down at School in Bridgenorth, and afterwards when a law student with a series of severe illnesses, but nothing checked his industry. He was led to take up the medical profession through some youthful investigations into the comparative value of foods, in which he had himself devised what are practically "Calories" as a basis of calculation. This work was typical both of his painstaking habits and of his ingenious methods. He entered at University College, London, and later on at Edinburgh, where he spent fifteen months as house physician. Lister, Sir William Roberts, Flower, Patrick Heron Watson, and Sir W. Gairdner, were among his companions. In one of his vacation tours at this time he went to the Orkneys and Shetland and commenced his investigations into the colour of the hair and eyes as an anthropological test, which was his chief hobby for most of his after life. He then served as a Civil Surgeon in the Crimea, and afterwards enjoyed a tour in Asia Minor, where he availed himself fully of the ethnological opportunities which the country afforded. Travels over various parts of Europe followed, and in 1857 he settled down to practice as a physician at Clifton, though the prospect was not encouraging, for at that time Symonds,

Budd, and Brittain, were in full activity. He was at first on the staff of the Dispensary, but ere long became physician at the Royal Infirmary, where Long Fox had also been recently elected. Even here, in the midst of professional work, he daily jotted down observations on the ethnological character of his patients, derived as they were from so many different stocks and races. In 1858 he married the daughter of the Rev. Alexander Christison, whose brother, Sir Robert, was so well known as a toxicologist. They lived in later years at the Manor House, and for some time previously at Mortimer House, Rodney Place. Near the latter there is still a monument of Dr. Beddoe's public spirit in the beautiful memorials to Chatham and the heroes of Clive's campaigns, which he rescued from destruction and re-erected on the edge of Clifton Down. They had been originally put up by Sir William Draper, the Conqueror of Manilla, when he retired to Clifton.

As early as 1853 Dr. Beddoe published *A Contribution to Scottish Ethnology*, and while at Clifton he started a collective investigation into *The Stature and Bulk of Man in the British Isles*, which cost him infinite labour in preparation for publication. In 1867 he gained the prize of a hundred guineas from the Welsh National Eisteddfod for his *Essay on the Origin of the English Nation*, and in the next year was elected President of the Anthropological Society. He had long been a member of the Ethnological, and after the union of the two bodies as the Anthropological Institute he was chosen President in 1889. He was a prominent figure at the Meetings of the British Association, and his brilliant work brought him many friendships among scientific men in every part of Europe, such as Topinard, Broca, and Virchow. At Bristol he took an active share in all public movements, in which he was ably assisted by his wife. In his vacation tours he made endless investigations into racial problems in Great Britain, Ireland, and on the Continent, but in 1885 he undertook a voyage to Queensland, where he had some financial interests. At this time, too, was published his celebrated work *The Races of Britain*, in which he showed the persistence and locality of the various stocks of which our population is composed, and in support of his arguments marshalled the statistics which he had collected during a life time. After a few years more of medical practice in Clifton he retired to the Chantry, Bradford-on-Avon, in 1891, where he still continued his scientific researches, and took his share in public work on the County and Urban Councils. His Rhind lectures on *The Anthropological History of Europe*, and his inaugural Long Fox lecture on *The Ideal Physician* were supplemented with a long list of contributions to scientific journals, continued up to the present year. His friends in 1907 subscribed for a portrait of him which hangs in the Bristol Museum, while a medallion by Greig Smith rests in the Medical Library, memorials of one of the ablest and most indefatigable scientists who have adorned this city.

G. PARKER.

The Pelophilous Formation of the Left Bank of the Severn Estuary.

By J. H. PRIESTLEY, B.Sc., F.L.S.

INTRODUCTION.

IN presenting this account of some very incomplete investigations upon the vegetation of a part of the left bank of the Severn estuary, I am influenced by the fact that circumstances will probably prevent my ever carrying the work nearer to a conclusion.

The investigation was begun really as a training for myself in ecological work, and with but little idea of its subsequent publication. However, it seems to me that for several reasons even a premature notice of the work may be better than none at all. The main reason is that the vegetation, to be subsequently described, is a very good example of the phenomenon of zonation, and for that reason early attracted my attention, as it is by no means easy to find a clear example of this phenomenon to bring to the notice of students. Furthermore, as will be pointed out, this zonation can very definitely be connected with the soil level and other edaphic factors.

Another factor influencing my decision to publish is that at the present day a very definite need of ecology is the more minute study of a small tract of vegetation, such as this was intended to be, and I hope that the result of the publication of the work at this stage may be to attract the attention of other local botanists to the subject. Perhaps this paper may justify its existence by leading later to a fuller elucidation of the interesting problems presented on such a clear cut scale by the sharp zones of vegetation on the alluvial mud stretching from Portishead to Oldbury-on-Severn and beyond. In the work upon this vegetation various workers in the Botanical Department of the University have at times interested themselves, and I am especially indebted to Miss F. MacIver for her cordial co-operation both in the tedious task of preparation of soil for analyses, and in the more difficult, if more interesting, anatomical and physiological investigations which have accompanied the work in the field. Unfortunately, at the present stage, it is not possible to utilize a large amount of the information so obtained; but I hope that at some later time it may be possible to continue and extend the anatomical and physiological observations, and so subsequently make more complete our knowledge of the structural and physiologic adaptation shown by the local flora. I should also like to express my thanks to Mr. J. W. White, F.L.S., for his unfailing kindness when I have had need, in connection with the field work, to refer to him for help with systematic problems.

Finally, my apology for the incomplete state of this work, in spite of the fact that it has now been in progress for several years, must be that it has of necessity been restricted to occasional holiday afternoons and week-ends, and subsequent work in the laboratory at incidental hours. The pressure of a large amount of teaching work, coupled with a considerable amount of more directly physiological research, have prevented me giving more time to the investigation.

AREA OF INVESTIGATION.

The detailed investigation I desired to make, limited the area of ground which could be covered with advantage.

The investigation, therefore, has been confined to the narrow strip of land outside the seaward dune, and submerged at the highest tides, which runs from Portishead up the shore of the Severn to Oldbury-on-Severn.

For the greater part of the distance this narrow strip consists of alluvial mud, covered at the higher levels with a close carpet of vegetation, but at one point below New Passage for a distance of about one mile, the vagaries of tidal currents are replacing the mud by shingle and sand with as a consequence changes in the vegetation.

From this shingle beach up to New Passage the whole frontage has been artificially changed, either by soil thrown out during excavations in connection with the Severn railway tunnel or by the construction of a strong stone barrier against the further incursion of the tides. This part of the shore owing to its partially artificial nature has received less attention from me, and is not described here, though the problem of the colonization of the shingle is an exceedingly interesting one. My attention has been chiefly directed to the vegetation formation that is characteristic of the alluvial mud within occasional or frequent reach of the tide, and it is this alone that is discussed in this paper.

THE STRAND FLORA.

The vegetation under observation then, has been what is often termed a strand flora. One of the characteristics of such a flora is that it is usually regarded as determined by *edaphic* rather than *climatic* factors; that is to say the flora of the shore seems to be chiefly determined by some factor connected with the nature of the soil of the shore itself. Thus the same main type of vegetation is found existing in many different climates, for instance from the Baltic, the Bay of Fundy, the Netherlands, and parts of the Tropics, the same general type of strand vegetation is described.

The main edaphic factor establishing this similarity of type of vegetation is almost undoubtedly the salt, for it may be found away from the sea shore, in the neighbourhood of inland salt marshes.

It is presumably not so much a chemical action of the salt that is directly responsible for its effect, as a more definitely physical effect exerted through its presence in excess. Thus Schimper and others have shown that the same general type of vegetation characterises nitrate deposits and the sodium carbonate deposits of Hungary.¹

Essentially then, a strand vegetation is to be regarded as a *halophyte* vegetation, and, perhaps, this is more particularly true of a mud formation lining a sea coast. The closely packed soil retains the salt to a far greater extent than the better draining soil, and probably the most characteristic halophyte vegetation will ultimately prove to be that of the mud, while sand and shingle vegetation may often fall rather into the category of the xerophyte. It is therefore convenient to follow Warming² in his use of such terms as lithophilous, pelophilous, &c., and in the limited district that I have studied, two distinct sets of problems are presented by the pelophilous or mud formations, and the psammophilous, *i.e.*, sand or shingle formations.

Climatic factors are the same for all the strand flora, and are therefore comparatively unimportant in a detailed study of a small area, but a very brief reference may be made to some of them before passing to the study of the pelophilous formation.

Light upon the open exposed strand vegetation is obviously a factor that will tend to be in excess; at the same time there is little indication, judging from the appearance of the plants during summer, when insolation effects are at their maximum, that this light exerts a deleterious effect upon vegetation, while the immediate response of the plants to a small shelter from the prevalent wind, even though they be still fully exposed to the sun, seems to suggest that the wind rather than the sun is responsible for the stunted growth.

The prevalent south-westerly winds exert a very considerable influence upon both the appearance and the occurrence of plants upon the left bank of the Severn, as this bank is very fully exposed to winds from this quarter. The striking effect of shelter from the prevalent winds is one of the first factors that strikes an observer of this vegetation. The growth of the strand vegetation under sheltered conditions can readily be observed on the banks of the little stream just above New Passage, and on the banks of the Trym where it joins the Avon at Sea Mills.

Some plants are very seldom found on the wind-swept zones lining the Severn bank, but appear immediately shelter is provided by a ditch or the angle of a small stream. The most striking examples of this are the species *Cochlearia anglica* L. and *Atriplex hastata* L.³

¹ Warming loc. cit. p. 218.

² Loc. cit. p. 223.

³ The nomenclature in this paper follows the list of British Seed Plants and Ferns, published by the British Museum, 1907, and revised by Rendle & Britten in accordance with the rules of nomenclature adopted at Vienna, 1905.

Cochlearia was very seldom found except in sheltered positions, and Atriplex never occurred in exposed places, while it was found in profusion below New Passage where part of the mud zone was protected by a bank of shingle on the seaward side.

Aster Tripolium L. and *Triglochin maritimum* L. are examples of plants which, while growing freely both in exposed and sheltered places, showed great differences in development, averaging from three to six inches in height in exposed zones, as compared with one to two feet or more on sheltered banks.

While *Salicornia europæa* L. grows nearest to the tide in exposed zones, *Aster Tripolium* L. is usually found in this position on the banks of sheltered inlets.

The average yearly rainfall in this region is about thirty inches, and may be taken as fairly uniform over the whole area. As the rainwater is probably an important factor in removing the salt from the upper zones of the halophyte formation, records have been kept at Bristol during the whole period of investigation. It was impossible to make measurements on the spot, and as a qualitative indication of the heaviness of the rainfall at certain periods was all that was necessary, a central station at Bristol was probably as suitable for my purpose as a station at one point on a long strip of coast.

THE PELOPHILOUS FORMATION.

Turning now to the pelophilous formation, somewhat fuller attention must be paid to the special factors which are responsible for the interesting distribution of the vegetation within this area. This is probably the oldest strand formation present on this coast, and is now somewhat rapidly disappearing, being either scoured out by the tide or replaced by piled shingle and sand.

There are several reasons for concluding that this formation is gradually going.

(1) Old maps, and the statements of the older inhabitants, make this formation—for instance in the neighbourhood of St. George's Wharf (between Portishead and Avonmouth)—reach much further out into the Channel.

(2) This formation, though outside the dune, is valuable grazing land, and is therefore fenced for the retention of cattle or sheep. In the neighbourhood of Aust several of these fences can still be seen dividing up a part of the coast from which by now nearly all the remains of this vegetation have been removed, so that the high tide now washes directly the exposed foot of the cliff.

(3) The whole appearance of the pelophilous formation tells the same tale, the zones are fringed by curious earth pillars undercut by the tide, and after high tides and storms many of these can

be seen to fall and their vegetation gradually changes into that characteristic of the next lower level. Since I have been studying this coast vegetation, additional patches of brushwood and stones have been inserted here and there at the crumbling edge of a zone to stay this onward march of the tide.

(4) In some places on the shore, for instance near Oldbury-on-Severn, the indications point to a small outer dune having been broken down by the tide, and as a consequence the vegetation of a strip of pasture land between the outer dune and an inner and stronger dune shows a tendency to go back to a more halophytic type. Such a tendency is undoubtedly retrogressive, and there is no doubt that the reclamation of this land and pasture by well built dunes is a comparatively recent process.

A very characteristic feature of this gradual subsidence and disappearance of the formation, is the manner in which the level sinks in definite zones. Evidently, as the scouring action proceeds and the outer mud is carried away, great pieces of the inner vegetation sink together, so that the vegetation falls in a series of steps. The difference in level between these steps usually occurs quite suddenly, and may be either just a few inches or as much as five or six feet. This is a very striking feature of the whole formation, and a very interesting one, because these sharp changes in level are accompanied by very sharp changes in the vegetation. The different levels within the formation present will therefore be discussed when the plant associations are described.

Another feature of the general nature of the formation is that, while the succession of plant associations that occur during the gradual disappearance of the vegetation stand out very clearly, but little can be said as to its method of construction; nowhere in this area have I found any indication of the building-up of such a halophyte formation, as Moss describes as occurring near Highbridge, lower down the Severn on the same bank.¹

Except in the uppermost zone outside the dune, a zone which is only present in a few places on this part of the coast, and which is so seldom submerged that its halophytic character is practically lost, the plants upon the whole of these zones belong unmistakably to the same general type. They are in nearly all cases low-growing herbs or small shrubs, either annual or perennial, only reaching a height of six inches to a foot on the open shore, even when grazing is prevented by local circumstances, but in places sheltered from the wind the flowering stalks of *Aster Tripolium*, *Triglochin maritimum*, &c., considerably exceed this height (see p. 12). All these plants possess either succulent or very reduced leaves, the commoner character being succulent leaves with woody stems.

¹ Moss loc. cit. p. 18.

Within these leaves the content of salt is very high. They possess glabrous cuticles, not appreciably thickened nor with the stomata sunk below the surface, neither is the number of stomata present below the general average for an herbaceous plant, so that in these respects their characters are not xerophytic. In the case of *Aster Tripolium*, counts of the stomata were made for several leaves, and in this dorsi-ventral leaf the number of stomata is somewhat greater on the upper surface, again by no means a xerophytic character.

TABLE I.

Stomata per square centimetre.

Leaf No.	Upper Surface.	Lower Surface.
1	4440	3810
2	5330	2270
3	4820	3030
4	7060	6070
5	6150	5080
6	4920	3630
7	6570	3120
8	4570	2080
9	6940	3400
10	6050	4260
11	5200	3750
12	4600	3560
Average number per square centimetre ...	5550	3670

The glabrous character of all the plants of this formation is a striking feature; in the zones that usually undergo submergence I have not found one specimen of a plant bearing hairs, though on the same formation at Clevedon, lower down the coast, I have found a single specimen of the shrub, *Obione portulacoides* Moquin, growing. This absence of hairs I am inclined to associate with the muddy saline water in which the plants are periodically immersed, though without experiment it is impossible to speak definitely. Owing to the scouring action of the tidal currents the channel water always carries a large amount of suspended matter with it ('557 grs. per litre is stated by Hann. quoted by Moss¹), and if plants with hairy surfaces are left suspended in this liquid for some time, the mud rapidly deposits in a thick film upon them, and subsequently cakes and sticks very firmly, perhaps partly on account of the salt in the water.

Many of the plants growing in the formation are often seen to be very muddy, but after comparing their appearance with that of hairy plants suspended in the same liquid and then left to dry,

¹ Moss loc. cit. p. 18.

I am driven to the conclusion that their appearance would be far worse had they possessed a hairy cuticle. Also it seems to me that the plants collect more mud as they grow older, presumably because the cuticle of the older plants is rougher and more cracked than that of the young plants. It seems to me then that the glabrous cuticle may be of use to the plants in preventing them from being covered with a layer of mud sufficiently thick to clog stomatal apertures and to obstruct the free entrance of air and light so necessary to their healthy growth.

Another great characteristic of the plants of this formation, is the tenacity with which they maintain their position in the mud, not merely securing to themselves a foothold, but often by their low much-branched stems embedded in the mud, or by the tenacious tangle of a fibrous root, actually holding around them a part of the zone which otherwise would succumb to the tide. Owing to the layered arrangement of the zones, the falling tide exerts a very considerable scour upon them, and they would disappear far more rapidly were it not for the holding power of the plants. The force at work causing denudation was well brought home to me one early spring morning upon which I had gone to Portishead to watch the effect of these tides on vegetation. The morning was very still, hardly broken by any noise at all as the tide came to its full height, but it had not been falling long, before, from all directions, there came a rapidly increasing sound of falling water. Heavy temporary waterfalls, falling perhaps from one to two feet, and extending for miles along the shore, soon brought to one's notice the scouring effect produced by the falling mass of water, and the masses of earth cut away and fallen from the top zone, and the rather deeper scour on the innermost edge of each zone where the falling water impinged upon it, needed no further explanation. It is quite evident that the only thing that enables these stepped zones to withstand the tidal scour so well is the close mat of plants upon their surface.

The plants at the edge of a zone are fixed most firmly; it is no uncommon thing to see a small *Festuca* or *Aster* or other plant at the edge of a zone, not more than three or four inches above the level of the mud, but with roots striking down into the soil from two to three feet or even further. *Aster Tripolium*, L., *Statice Armeria*, L., and *Festuca rubra*, L., are examples of plants which help to retain the mud surface from denudation by their closely matted branched stems just below and upon the surface of the ground.

A consideration of this phenomenon leads one to wonder whether the various fences, stone barriers, &c., employed are the most effective means of preventing tidal scour; or whether more might not be done by means of a *sloping* bank covered by the natural turf, and at the same time by its contour free from these little waterfalls during the ebbing tide, and therefore far less liable to scour.

THE ZONES AND PLANT ASSOCIATIONS.

As the relative levels of the zones differ at various points along the shore, it is not easy to give a general classification of the zones that will hold for the whole area, but the different zones can well be recognised by their different plant associations.

There are four main zones with their associations thus to be distinguished, viz. :—

- (I.) The *Salicornia* Zone.
- (II.) The *Sclerochloa* Zone.
- (III.) The *Festuca* Zone.
- (IV.) The Alluvial Pasture Zone.

(I.) Lowest in position and running gradually over into the bare mud, there is often present an open association of *Salicornia europæa* L. No other Phanerogam is present within this zone, the only other plants present being gelatinous masses of diatoms, and occasionally tangled masses of species of *Enteromorpha* tangled amongst the stems of the *Salicornia* and left behind by the tide. Near Portishead this *Salicornia* zone is a very prominent fringe, reaching in places to some two hundred yards in width, but as one proceeds up the Severn the fringe rapidly diminishes in extent until only occasional patches are met with. Above Aust it is usually quite absent.

(II.) Next in order, proceeding inland, is the zone which might be suitably named after the dominant grass the *Sclerochloa* zone. In this zone *Sclerochloa maritima*, Lindley, is either dominant or co-dominant in company usually with *Aster Tripolium*, L., though occasionally other plants in the zone may become so conspicuous as almost to deserve the name of co-dominants. This zone is seldom raised much above the *Salicornia* zone when that is present, the difference in level varying from two to three inches, as at Portishead, up to perhaps one and a half to two feet, as at some places near New Passage. In some spots, notably at the area above Portishead, known as St. George's wharf, the *Sclerochloa* zone is disappearing and rapidly being replaced by a thick growth of *Salicornia*. The little islands of *Sclerochloa* and *Aster* are surrounded and almost overwhelmed by the *Salicornia* growing thickly in the shallow channels of mud between them.

The list of plants for this zone is as follows—

- Plantago maritima*, L.
- Triglochin maritimum*, L.
- Glaux maritima*, L.
- Suaeda maritima*, Dumortier.
- Alsine marginata*, L. H. G. Reichenbach.
- Salicornia europæa*, L.

Glaux shows considerable vegetative growth, but flowers very little and later than it does in the next higher zone ; the remainder of the plants in this list flower and fruit freely.

Cochlearia anglica, L., grows at about the level of this zone on the sides of streams where it is sheltered from the wind, but in the exposed zones the occasional plants met with are always in the next higher zone.

This zone is very characteristic when well developed, and may be of considerable width, but at its outer and inner margins it is often not true to type. At the outer margin, when this is the best drained portion of the zone owing to a sharp fall between this zone and the *Salicornia* zone or mud below, it is very often lined with a fringe containing the characteristic plants of the *Festuca* zone above. At the inner margin there is often a curious blending of the two other zones, the *Salicornia* and the *Festuca*. The *Salicornia* patches obtain a footing where the fall of water from the zone above has scoured out the zone to a depth of two or three inches below its usual surface. The *Festuca* association patches represent patches of the actual upper zone fallen off from above, and not yet converted into the association typical of the lower level, a process that may take two or three years to accomplish.

(III.) Above the *Sclerochloa* zone, and usually separated from it by a fall of two or three feet, though sometimes by five or six, there is present a more densely populated zone containing a greater number of species owing probably to the less stringently saline conditions. This zone varies in regard to its dominant plant, but may be termed the *Festuca* zone after its most common dominant, a low growth of the species *Festuca rubra*, L. But occasionally the grass is almost entirely driven out by dense patches of other plants, more commonly by tufts of very short specimens of *Juncus Gerardi*, Loiseleur. These two plants are the usual dominants of the zone, but in places where a steep fall to the next zone has enabled it to drain particularly well, or where its height takes it a little further than usual out of reach of the tides, then other plants may attain to a partial dominance; thus above Aust, in a particularly well-drained patch which seems really to belong to this zone, the plants occurring as co-dominants in addition to *Festuca* and *Juncus* are—

Hordeum nodosum, L.
Triticum pungens, Persoon.
Triglochin maritimum, L.

The following plants are also usually common in this zone—

Plantago maritima, L.
Plantago Coronopus, L.
Alsine marginata, Reichenbach.
Glaux maritima, L.

While very rarely the following have also been found—

Statice Armeria, L., few specimens.
Cochlearia anglica, L., few specimens—great quantities on sheltered banks (see p. 11).
Bupleurum tenuissimum, L., one specimen—near New Passage.

A curious feature of the vegetation of this zone has been the occasional appearance of a number of plants of *Salicornia europæa*, L., in the early autumn or late summer, apparently after some high tide. A number of these have been found growing amongst the close turf at this time, but before they have grown more than a few inches they die down again.

(IV.) Above this zone there is occasionally to be seen traces of a fourth zone, which closely resembles the associations to be found on the reclaimed levels within the dune, and which therefore seems to owe its existence largely to human activity in improving drainage, &c., and is an example, therefore, of what Dr. W. G. Smith¹ terms a "substituted" association. This zone is so typically not halophytic (see p. 21 for soil salt content) that I have paid but little attention to it, but it closely agrees so far as I have observed with the account given by Moss.²

These four zones are not always all present. IV. in particular is only occasionally seen; it occurs between St. George's wharf and Portishead, and in several places above Aust.

III. occurs nearly all the way up from Portishead to Oldbury-on-Severn, except where sand and shingle break the sequence. It is also missing just above New Passage.

II. occurs at Portishead, is disappearing at St. George's wharf, is occasionally missing above Avonmouth, and disappears just below Aust, only to reappear very occasionally.

I. is a fringe narrowing from Portishead upwards, ceasing below Aust.

CAUSES OF ZONATION.

With zones so sharply delimited by features in their vegetation, it was natural to seek to establish a relation between the zones and some edaphic factors.

The sharp fall between the zones results in efficient drainage at the margin of each zone, and this in its turn probably reacts upon the salt content. This may be made clearer by reference to a diagram (Fig. I).



TEXT FIGURE I.

¹Smith, W. G., loc. cit.

²Moss, loc. cit., p. 20.

In this diagram the zones are numbered and three points distinguished upon each, which require some little discussion.

The point A on any zone will always tend to be a little *below* the normal level of the zone, because of the tidal scour caused by the fall of water from the zone above as the tide recedes. This means that the water will tend to stand about here as the tide falls, while from its position the drainage in the case of a wide zone will be slow. A, therefore, will always represent a point of bad drainage, where the salt content is likely to be high.

B. should be a place of poor drainage in a level and wide zone, and should represent what might be called the typical drainage and salt condition for that particular association.

C., on the other hand, should always be well drained, more porous and much freer from salt.

These conditions might explain the occasional appearance of a relatively lower zone at the point A on one zone, and of a relatively higher zone at the point C (see p. 17).

It seemed advisable to see whether these theoretical conditions were borne out in practice, and for this purpose a number of soil samples were taken and investigated. The soil is particularly suitable for this purpose owing to its uniform structure. Being a soft clay, suitable samples could be obtained by means of a geotome,¹ of diameter $1\frac{1}{4}$ inch, the samples in a series being always taken to the same depth, pressed out from the tube direct into a well corked bottle and then taken back to the laboratory for investigation. Some idea as to the drainage capacities of the soil can be obtained from the water content, taken in conjunction with previous rainfall, so that the water content was determined with most of the samples.

The total chlorine present was estimated in most series by a gravimetric method; in one or two of the later series, titration with standardized solutions of silver nitrate was resorted to, to save time. The gravimetric method used was a modification of Wolffs' method,² the dry soil being treated with excess nitric acid. A fairly strong solution of nitric acid was needed for some soils as the carbonate present was in many cases considerable. In one series of soils the CO_3 present varied from about 4.5% to 9.3% of the dry soil. The same strength of nitric acid was always used in any series of determination, the dissolved chloride being filtered off, precipitated with excess silver nitrate, and the precipitate collected on asbestos in a Gooch crucible dried at red heat and weighed as silver chloride.

¹ Clements, loc. cit. p. 25.

² Wiley, loc. cit. p. 474.

In the following table the results of several typical series of observations are given.

TABLE II.

Date of Collection of Samples.	Rainfall previous 30 hours (see p. 12).	Rainfall previous week (see p. 12).	Length of Core.	Position from which Core taken (see Figure I).	Percentage of Moisture calculated on original weight of Soil.	Percentage Chlorine calculated on dry weight of Soil.	REMARKS.
1909.							
June 26	0·16	2·48	4 ins.	Nr. Portbury	III. A.	— 0·98	
"	"	"	"	"	III. B.	— 0·72	Bare piece of ground.
"	"	"	"	"	III. B.	— 0·37	Nr. edge of shallow pit
"	"	"	"	"	III. B.	— 0·81	Bottom of shallow pit
"	"	"	"	"	III. B.	— 0·72	Typical spot.
"	"	"	"	"	II. A.	— 0·86	
"	"	"	"	"	II. B.	— 0·60	
"	"	"	"	"	II. C.	— 0·72	
"	"	"	"	"	I. A.	— 0·50	
"	"	"	"	"	I. B.	— 0·56	
"	"	"	"	"	I. C.	— 0·73	
June 26	0·16	2·48	4 ins.	Nr. Portishead	III. A.	— 1·11	
"	"	"	"	"	III. B.	— 0·92	Shallow pit scoured.
"	"	"	"	"	III. C.	— 0·45	
"	"	"	"	"	II. A.	— 1·13	
"	"	"	"	"	II. B.	— 0·95	
"	"	"	"	"	II. C.	— 0·79	
"	"	"	"	"	I. A.	— 0·75	
"	"	"	"	"	I. B.	— 0·70	
Dec. 11	0·42	0·64	6 ins.	Nr. Portishead	III. A.	33 0·64	[approximate.
"	"	"	"	"	III. B.	34 0·2·0·3	Chloride result only
"	"	"	"	"	III. C.	27 0·16	
"	"	"	"	"	II. A.	31 0·38	
"	"	"	"	"	II. B.	33 0·37	
"	"	"	"	"	II. C.	28 0·41	
"	"	"	"	"	I. A.	35 0·36	
"	"	"	"	"	I. B.	39 0·42	
"	"	"	"	"	I. C.	47 0·68	
Dec. 11	0·42	0·64	6 ins.	Between Portishead and Portbury	III. A.	42 0·62	
"	"	"	"	"	III. B.	36 0·40	
"	"	"	"	"	III. C.	31 0·13	
"	"	"	"	"	II. A.	32 0·80	
"	"	"	"	"	II. B.	32 0·31	
"	"	"	"	"	II. C.	38 0·32	
"	"	"	"	"	I. A.	33 0·35	
"	"	"	"	"	I. B.	34 0·32	
"	"	"	"	"	I. C.	43 0·58	{ Amongst roots of a patch of <i>Aster</i> left here.
"	"	"	"	"	I. C.	36 0·35	Amongst <i>Salicornia</i> .
"	"	"	"	"	—	40 0·02	Soil from other side of dunes.

TABLE II.—*Continued.*

Date of Collection of Samples.	Rainfall previous 36 hours (see p. 12).	Rainfall previous week (see p. 12).	Length of Core.	Position from which Core taken (see Figure I).	Percentage of Moisture calculated on original weight of Soil.	Percentage Chlorine calculated on dry weight of Soil.	REMARKS.
1910.							
Jan. 11	0·36	0·61	6 ins.	Between New Passage and Aust	I. C. 27	0·21	From tuft of <i>Sclerochloa</i> left from mud near this.
"	"	"	"	"	I. C. 42	0·47	Rise from I. to III. is 1½ feet.
"	"	"	"	"	III. C. 28	0·06	
"	"	"	"	"	III. B. 25	0·08	
"	"	"	"	"	III. A. 24	0·23	
"	"	"	"	"	IV. C. 32	(trace only)	Rise from III. to IV. is 2 feet.
"	"	"	"	"	IV. B. 36	0·02	IV. zone tends towards substituted levels association.
"	"	"	"	"	IV. A. 40	0·03	
Jan. 11	0·36	0·61	6 ins.	Just above Aust	II. C. 26	0·09	There is no I. zone here and II. is very narrow.
"	"	"	"	"	II. A. 20	0·24	
"	"	"	"	"	III. C. 27	0·03	II. here splendidly drained, 5 feet fall to mud below, III. 1½ to 2 feet higher, & vegetation tends to type of IV.
"	"	"	"	"	III. B. 30	0·05	
"	"	"	"	"	III. A. 29	—	
April 1	0	0	4 ins.	Oldbury-on-Severn	III. ^a C. 28	0·45	III. ^a & III. ^b represent lower & higher strata respectively, both of <i>Festuca</i> zone. IV. zone separated from III. by low dune which is disappearing.
"	"	"	"	"	III. ^a B. 38	0·41	
"	"	"	"	"	III. ^b C. 46	0·48	
"	"	"	"	"	III. ^b B. 24	0·49	
"	"	"	"	"	III. ^b A. 36	1·31	
"	"	"	"	"	IV. B. 37	1·15	
"	"	"	"	"	IV. A. 48	0·04	
April 1	0	0	4 ins.	Lyttleton Worth	II. C. 27	0·79	Zone II. very narrow.
"	"	"	"	"	II. B. 37	1·95	
"	"	"	"	"	III. C. 41	0·59	
"	"	"	"	"	III. B. 47	1·34	[more species.
"	"	"	"	"	III. B. 56	0·76	Vegetation contains
April 1	0	0	4 ins.	Just below Aust	II. C. 39	1·23	
"	"	"	"	"	II. B. 41	1·75	
"	"	"	"	"	III. ^a C. 30	0·72	III. ^a and III. ^b lower and higher strata respectively of <i>Festuca</i> zone, which is double here.
"	"	"	"	"	III. ^a B. 35	1·18	
"	"	"	"	"	III. ^b C. 37	0·99	
"	"	"	"	"	III. ^b B. 29	0·33	
"	"	"	"	"	III. A. 45	0·53	

DISCUSSION OF TABLE II.

It is clear that one result of the marked difference in level between the zones in this formation will be that the number of times they are submerged and the duration of this submergence will be very markedly different. It is only possible to give approximate figures, but calculating from tide tables, coupled with measurements made at the time of full tide on a calm day, I estimate that during 1910 the *Festuca* zone at Portishead was submerged by 40 tides, the *Sclerochloa* zone by 110, and the *Salicornia* zone by 150. The duration of submergence would also of course vary in about the same proportion.

This would lead one to expect that the *Salicornia* zone would have the least opportunity of having its salt content removed by drainage after rain, and a reference to the Table shows that the percentage of chlorine never falls so low in the *Salicornia* zone. The minimum readings for the zones are as follows—

<i>Salicornia</i> zone ...	...	...	0·21 %
<i>Sclerochloa</i> zone	...	...	0·09 %
<i>Festuca</i> zone ...	...	...	0·03 %

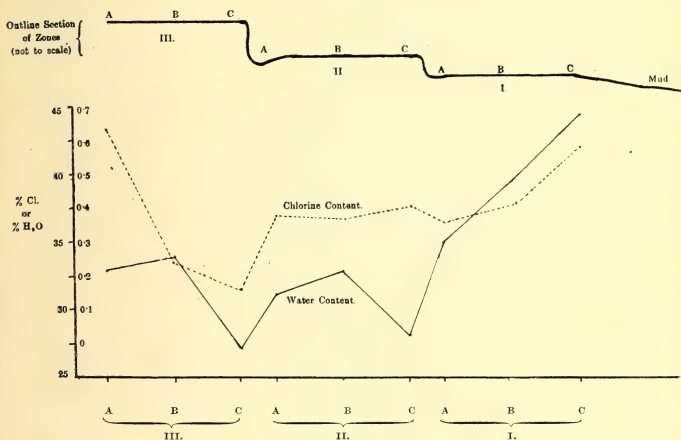
If minimum results only were considered it would appear surprising that the whole formation was so definitely halophytic; thus the normal chlorine content of the reclaimed pastures is 0·02 %, and Warming states¹ that in a rapidly drying clay such as is present here 1 % sodium chloride is required to expel all plants but halophytes (1 % Na Cl. would be equivalent to 0·6 % chlorine).

It is thus surprising to find the *Festuca* zone so markedly halophytic until the other chlorine figures for this zone are considered, when it will be seen that the maximum figures for salt content appear in this zone at positions removed from the margin. The percentages of chlorine rises to such a figure as 1·34 % during a spell of dry weather; for April 1st, 1910, had been preceded by an absolutely dry fortnight, and the total rainfall for the previous month was very small. This result is to be accounted for presumably by two factors, first the inefficient drainage preventing the water from the high spring-tides running away freely—the zone had probably been submerged about seven times without any subsequent rainfall—and secondly by the salt being retained in the upper four inches of the soil by the action of surface tension and evaporation. This same zone after heavy rain will show a chlorine content, probably in the neighbourhood of 0·2 %—0·4 % (see readings for Dec. 11th, 1909), while under exceptional conditions for drainage in a time of low tides it may fall even lower (see readings for January 11th, 1910).

The distinctive difference between the three zones as regards halophytic factors seem then to be connected with drainage

¹ Warming, loc. cit. p. 218.

and consequent removal of the salt by rainfall. All three zones are liable to high salt percentages during times of drought and high tides, but the *Salicornia* zone has practically no relief from these conditions, while the higher *Festuca* zone is often free from them, and the *Sclerochloa* zone at its margin may become so free from salt by drainage that its conditions and therefore its vegetation become equivalent to that of the normal *Festuca* zone. The relation between salt content and drainage is shown clearly in some of the series taken after rain; it for instance can be shown diagrammatically, as is done in Figure II., for the series taken near Portishead on December 11th, 1909.



TEXT FIGURE II.

If the two series of points plotted in this diagram are compared, it is clear that high water content, that is to say defective drainage usually accompanies high salinity.

The only marked exception in this series is the chloride percentage for II. C, which is comparatively unusually high. Perhaps this is to some extent due to the fact that the fall from II. zone to I. zone is not very great at this part of the coast, being only some six inches to a foot.

Except for one reading taken during the dry weather of the Spring of 1910, the few readings from zone IV. show low chlorine content coupled with high water content. The explanation is certainly, I think, the much greater amount of humus present in the soil, owing probably to grazing and cultivation without the scouring effect of any but the most occasional tide to remove the manure and decaying matter on the surface of the ground. This humus so improves the texture of the surface layers of the ground that the salt rapidly draws away after the occasional

tidal submersion, while at the same time its retentivity for soil water raises the water content of the soil above that of the neighbouring halophytic zones.

While, then, the halophytic formations of the shore seem to be directly connected with the varying salt content, I am unable to suggest in what manner this salt content directly affects the plant. Its effect is probably in part a direct physiological action on the plant and at the same time an indirect action due to its action on the structure of the soil.

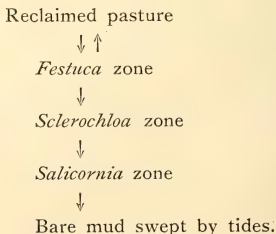
The presence of salt in the water causes this clay to more rapidly settle out of a state of colloidal suspension. Thus, in a typical experiment, if 5 grams of the dry soil be shaken up in one case with 250 c.cs. of distilled water, in the other with 250 c.cs. of 1 % sodium chloride, at the end of 15 minutes more of the soil will be deposited as sediment from the salt solution. In an actual experiment 4.72 grams settled from the salt solution as compared with 4.63 grams from the distilled water. Sodium chloride then behaves as a normal electrolyte and precipitates these colloidal suspensions, and probably does to some extent obstruct the drainage of the heavy clay. At the same time, so long as tidal scour prevents the accumulation of humus, the drainage of the formation cannot much improve, and probably that is the main factor in keeping the salt in the soil and the vegetation typically halophytic.

SUMMARY.

The vegetation of the pelophilous formation of the Severn shore provides an excellent example of zonation of halophytic associations. These zones occur at different levels owing to the gradual subsidence of the land outside the seaward dunes, as a consequence of tidal scour.

Below the reclaimed pasture forming an occasional upper layer outside the dune, the land steps down in three main zones, which may be termed the *Festuca*, *Sclerochloa*, and *Salicornia* zones respectively.

The vegetation of these zones is described in some detail, and the fact brought out that they tend to pass into one another as the land subsides. The series may be diagrammatically expressed thus—



In this area no indication was seen of the process of building up of the zones, so that I cannot state whether the same series of associations is passed through in reverse order, undoubtedly the *Festuca* zone can at any time be reclaimed by preventing tidal subsidence and cultivating.

The relation of this series of zones to salt content and drainage has been investigated, and as the result of a number of analyses the following conclusions are drawn—

(1) The halophytic character of the vegetation is accounted for by the high chlorine content to be found in all zones after tidal submergence.

(2) The greater number of species present in the higher halophytic plant association can be attributed to better drainage, contributing with periods of good rainfall and low tides to the occurrence of periods of very low salt content.

(3) The minimum salt content in the lower zones on the other hand is uniformly higher than the minimum content for the higher zones.

(4) The reclaimed pastures owe their existence to an almost uniformly low saline content, to be attributed to two factors,

- (a) Infrequent tidal immersion owing to their higher level.
- (b) Improved surface drainage due to accumulation of humus.

REFERENCES.

(The literature on halophyte vegetation is now very extensive, and no attempt has been made to compile a bibliography. I simply append a list of a few books and papers to which it has been necessary to draw attention in the text).

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Notes on a few Birds of the District.

By D. MUNRO SMITH.

AN extraordinary irruption of Crossbills (*Loxia Curvirostra*) into England, took place in the year 1909, flocks being general in most of the Southern Counties in September, while there was a fair number of records of their breeding in the ensuing spring (1910). I noticed a flock first at Kingsweston, in the middle of August, and during the winter large flocks were common in the neighbourhood. They fed on the seeds of the larch, transferring their attention, as spring came on, to those of the Scotch fir. I noticed a hen building at Kingsweston, on February 23rd, 1910, in the top of a larch, and the nest contained two eggs on March 10th. It was made of shreds of clematis on a foundation of larch twigs. I subsequently found two other nests, one in a larch, one on the bough of a spruce. There was another record of their nesting at Long Ashton, in 'The Field.' There is a nest very similar in construction to the one I saw in the Bristol Museum. There was a flock at Kingsweston in the spring of this year (1911), but I am not able to say if any nested. The Crossbill is usually an irregular autumn and winter visitor to this country, but in periods of from three to ten years, large immigrations occur, the birds being almost common in coniferous plantations in most parts of the country, and instances are recorded of their stopping to breed. The causes of these immigrations have still to be discovered. Possibly they are due to the failure of the seeds of conifers on the Continent.

The country of our district is a very varied one, and for this reason a fair number of widely different species are to be found within a small radius from the city.

The Lesser Redpoll (*Linota Rufescens*) in some seasons nests on the Downs and in the gardens round Stoke Bishop, in fair numbers, but in other seasons its trill is a very unusual sound. In winter it is seen in flocks feeding on the seeds of the birch. Last winter I saw no lesser redpolls, and at the same time noticed that the birches had, mostly, very few seed catkins.

The Rock Pipit (*Anthus Obscurus*) nests on the Sea Walls and on St. Vincent's Rock above the Hotwells Station. It is essentially a shore-bird, and it is not common to find it nesting away from the sea.

That very handsome bird, the Sheld-duck (*Tadorna Cornuta*), can be seen on the ooze of the Channel shore on both sides of the Avon. The typical nesting-place is at some depth in an old rabbit burrow, but with us their habits are different, and they lay their eggs in old hollow pollards in the adjoining marshes.

The bunting that nests closest to the city is the Cirl Bunting (*Emberiza Cirlus*), a local species in the South of England. The cock has three distinctly different songs, but each song may be described as a monotonous trilling chatter. It is difficult to describe the different notes, but the bird repeats each about a dozen times before changing. You need to be close to see the cock's plumage. He is a very handsomely marked bird. I have seen a nest at the bottom of the Gully, on the embankment. There are two other buntings in the district, the Reed and Yellow Bunting.

We have not many Ornithologists in the district, and I am sure there are still several records to be added to our local Bird List. The marshes and flat fields by the Severn shore, and some of the nearest points of the Mendip Hills, particularly, would repay careful exploration.

THE CYSTIDIA OF *COPRINUS COMATUS*.

F. DE LA MARE NORRIS.

COPRINUS, the ink fungus, like most of the Agaricineae, has its spore-bearing layer or hymenium on the under surface of an umbrella-like structure, the pileus, which is raised above the ground on a long stipe. This hymenium covers the surface of a number of gills radiating from the stipe to the margin of the pileus, the adjacent gills lying very close to one another. The spores borne upon the gills ripen progressively from the lower margin upwards and, as they are set free, the tissue of the gill gradually deliquesces. The cystidia are special large cells present amongst the spore-bearing cells or basidia (see Fig. II.) in the hymenium, but themselves bearing no spores. As to the function these cystidia perform various theories have been advanced. At one time they were regarded by some as male organs, and one writer, Worthington Smith¹, went so far as to state that they were antheridia, which produced spermatozoa. He was of the opinion they fell to the ground and that the liberated spermatozoa found their way to the spores, and by fusing with them brought about fertilization.

One writer figured them as flasked-shaped bodies, the mouths of which were closed by lids, and he thought that the contents of each cystidium escaped by the breaking off of the lid. He does not state whether he ever actually observed the lids, and it is quite easy to account for the flask-shaped cystidia, with the cell contents issuing from their necks, in quite another way, to which I will refer later after dealing with the true function and structure of the cystidia.

It is thought by many that the cystidia exude a digestive enzyme which acts on the tissue and causes it to decompose. This is what causes the fungus, as it grows older, to disorganise into a slimy, black, inky mass, from which fact the fungi derive their common name of "Ink-Fungi." The spores ripen in definite zones, beginning at the base of each gill and progressing upwards to the top, and it is thought that by the falling off of the older and useless parts of the gills that the ripe spores have an easier access to the outside. Each zone of cystidia has entirely vanished before the zone of spores above it is ripe so that there is no fear of the spores adhering to the sticky decomposing mass. Whether it is only the cystidia that exude this digesting enzyme, or whether the paraphyses and old basidia share in the work, we do not know.

But the cystidia have another important function, a function of which, after the work of A. H. R. Buller², which has recently

¹ W. SMITH, *Grevillea*. Vol. IV., 1875-76, p. 30.

² A. H. R. BULLER. *Annals of Botany*, XXIV.

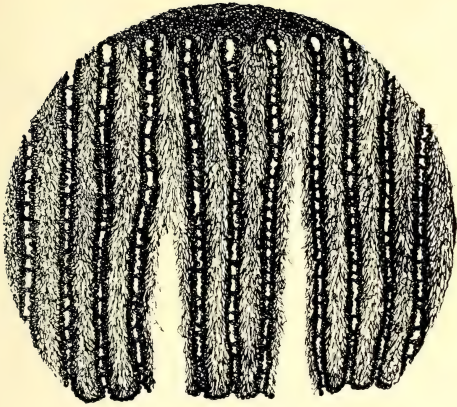


FIGURE I.

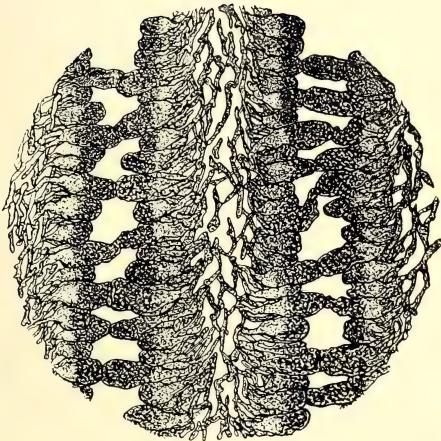


FIGURE II.



FIGURE III.

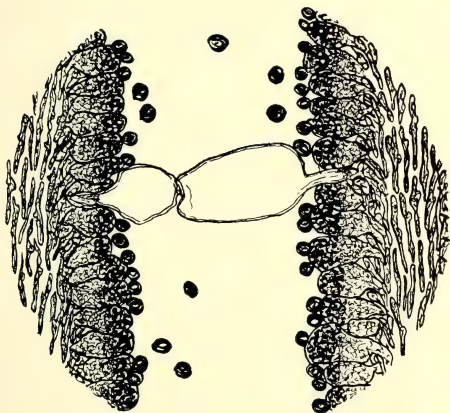


FIGURE IV.

appeared in the Annals of Botany, there can be little doubt. This function, like the last, is also to facilitate spore distribution, but in a different manner. The gills of *Coprinus* are very thin and film-like, and it is certain that without the cystidia they would in all probability become stuck together by moisture and other external causes in such a way that spore distribution would become impossible. The cystidia grow out from the surface of one gill and become embedded in the tissue of the opposite one. They are sufficiently numerous to keep the gills apart, and to add to the firmness of the structure by binding them all firmly together.

In the species figured by Buller (*Coprinus atramentarius*), each cystidium consists of a large cylindrical cell, one end of which is narrow and inserted in the hymenium, from which it grows out; the other end is rounded off and becomes embedded in the tissue of the opposite gill, where it appears to become fixed.

In the species which I sectioned (Fig. I.-II.) (*Coprinus comatus*, Fr.), instead of stretching from one gill to the other, like those figured by Buller, two cystidia, arising from opposite gills, fuse together where they meet between the surfaces of either gill, and in this way bridge over the space between the gills and thus serve the same purpose as those in *Coprinus atramentarius* already described. In some cases the two fusing cystidia are opposite each other, in others they are slightly displaced, and in the latter case one cystidium often bends round from its original position in order to fuse. (Fig. II.).

The complete way in which these cystidia fuse is shown by the fact that it is impossible to separate the gills without breaking the tissue, and in nearly every case when an attempt has been made to separate them, the cystidia have remained fused and the gills have split in half, still attached by their surfaces. (Fig. I.). In other cases when an attempt has been made to separate them, the Cystidia have broken away from the gill in which they originated (Fig. III.) and have a flask-like form, due to the fact that they often draw out with them part of the narrow hypha from which they have arisen. This hypha is, of course, open at the end, with the contents exuding to a greater or less extent from the opening, and it is probable that this is what was observed—though in a species in which the cystidia were embedded in the tissue of the opposite gill—by the writer who pictures them as the flask-shaped cell with lids.

The above description is based on observations of young fructifications. Fig. IV. is drawn from a section of mature material. The cystidia are in this case essentially the same as in the previous one, the chief differences seem to be that they are fewer in number, some evidently having degenerated; they are also much larger; the gills in this way have become still more separated; the cystidia have also become transparent. Many may still be seen torn away from the tissue of the gill and remaining attached to the fused cystidia of the opposite gill.

Report of Meetings.

For the year ending December 31st, 1910.

SPECIAL features of the Session were, in the first place, the lectures held in connection with the Geographical Association on November 9th, when Lieut. Etherton lectured to an audience of about 120 on his travels "From India to Siberia," and, in the second place Capt. Mackay's account of the work of the recent "Sleeping Sickness Commission in Uganda," which was delivered to an audience of about 100 members and friends.

The Presidential Address by the retiring President, Mr. J. W. White, F.L.S., entitled, "History of Bristol Botany" (Part III.), was given on Thursday, January 20th; other meetings were held as follows:—

Jan. 20th.—Annual Meeting. Presidential Address, Mr. J. W. White, F.L.S., "History of Bristol Botany" (Part III.)

Feb. 22nd.—Dr. W. A. Smith, M.A., "Tennyson as a Naturalist."

Mar. 10th.—C. Bucknall, Mus. Bac., "Comets and the Solar System."

April 14th.—G. Munro Smith, M.R.C.S., L.R.C.P., "Notes on some Birds of the District."

May 5th.—Dr. J. Stuart Thomson, "Seasonal Changes in the Life of Fishes."

Oct. 6th.—J. H. Priestley, "From Fern Frond to Flower."

Nov. 9th.—Lieut. Etherton, "From India to Siberia across the Himalayas." (Joint Meeting with the Geographical Association).

Dec. 8th.—Capt. Mackie, I.M.S., F.R.C.S., "Sleeping Sickness in Uganda."

GEOLOGICAL SECTION.

THE year commenced with 40 members only, which is a great falling off from previous years, and I regret to report there has been a falling off each year for the last four years.

There have been seven meetings during the year, when the following papers were read:—

January 27th.—"The Geology of the South Wales Coalfield," by Prof. W. S. Boulton (illustrated by Lantern Slides and Maps).

February 22nd.—"Beekite, an interesting local mineral" (illustrated by Photographs and Lantern Slides), by W. H. Wickes.

March 17th.—“The Lias around Radstock” (illustrated by Sections, Maps, and Lantern Slides), by J. W. Tutcher.

April 28th.—“Notes on a Journey in Western America in the Summer of 1909” (illustrated by Lantern Slides and Rock Specimens), by the President—Prof. S. H. Reynolds.

October 19th.—“Pre-Cambrian Rocks, with special reference to recent work in Canada and South Wales” (illustrated by Specimens), by the President—Prof. S. H. Reynolds.

November 17th.—Exhibition Meeting.

December 15th.—(a) “A Rhætic Dyke at Redhill, Somerset” (illustrated by Sectional Maps), by H. F. Barke. (b) “*Ostrea liassica* and its Mutations” (illustrated by Drawings and Specimens), by J. W. Tutcher.

There was an average attendance of 15 members and friends.

The Financial Report and Balance Sheet shows a total receipt of £7 15s. 2d., including a balance of £2 7s. 8d. brought forward from 1909, and an expenditure of £4 10s. 2d., leaving a balance in the hands of the Treasurer of £3 5s.

B. A. BAKER, F.G.S., *Hon. Sec. and Treas.*

ENTOMOLOGICAL SECTION.

FEBRUARY 15th.—Dr. Rudge exhibited specimens of Hemiptera and a glass ants' nest constructed for observation purposes. Mr. Griffiths specimens of *Caudalides cyprotus*, *Lycæna Scintinata*, *L. felderi* and *Hesperia*—*Nov. sp.?* all from Queensland, also *Sphinx convolvuli*, Queensland, *S. cingulata*, Florida, and *S. gordius*, Texas. Hon. Sec. showed some peas infested with the beetle *Bruchus pisi*, also a box of butterflies from N. Nigeria, 1909.

April 12th.—Mr. Griffiths exhibited a large number of specimens of lepidoptera. Dr. Rudge, living specimens of *Timarcha coriaria* from Guernsey, and Hon. Sec. a box of British coleoptera.

CHAS. BARTLETT, *Hon. Sec.*

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Nature's Appeal.

By G. MUNRO SMITH, M.D.

WHAT exactly is the impulse which induces people to study Natural History? What is the relationship, if any, between this impulse and the so-called "Love of Nature," which is so prominent a feature in the writings of many of the great poets? I must first endeavour to explain the meaning of this enquiry.

It is, of course, a common thing for people to study Natural History and to become very fond of it. It is also very usual for people to say they are fond of Natural History when they really care very little about it. In the same way, people nearly always say they are fond of literature, whereas it is obvious that in many cases they are absolutely indifferent to it. Some take to the study of Biology, or some branch of science, because they are born and bred in scientific surroundings; they are induced by their parents and friends to follow in their footsteps. Others are of an enquiring mind, and take pleasure in investigation of all kinds, especially in that which requires minute examination or analysis, or which may help to unravel interesting problems. The passion for investigation is too strong in some to be satisfied by any ordinary occupation. We have all met children who have a perfect mania for asking difficult questions, and even for experimental attempts to solve them. It is stated that a small boy, deeply impressed with the story of Daniel in the lions' den, ascertained from one of his parents that it was because Daniel was so good that the lions did not eat him; and having made sure, from further enquiries, that his little brother aged four years was one of the best boys that ever lived, he was found deliberately trying to get the aforesaid brother as near the bars of the lions' cage, at the Zoo, as possible, in order that he might test the statement that good people were not acceptable to the larger carnivora. Others find that of all their School or University studies, Natural History is rather more interesting than the rest, and "take it up," with neither love nor hatred, as a means of getting a living, or perhaps of making a name. Others are led to believe that the study of natural phenomena is the best form of mental culture. Huxley's Lay Sermons, for instance, must have induced thousands of men to educate their sons in the lines he so eloquently recommends. There is another large class which sees in Nature a great and solemn beauty; they do not care for dissection of animals or plants; they are not fond of classification or naming; but they delight in Nature because of her beauty. Many of these are influenced also by a poetic temperament, and weave into what they see or hear the thoughts of the poets who have, to them, made Nature still more lovely. But it is not of any of these, or only to some extent of the last kind, that I wish to speak to-night. I think you will agree with me that there is another large class of what one may call born naturalists or nature-lovers, who take

to their favourite pursuit quite uninfluenced by any reasoning or any question of advantage to themselves or others. They are drawn to it by some strong inward tendency. Nature appeals to them, and they are almost bound to obey the summons. They hear the siren's voice, and follow her. They cannot explain the pleasure they feel in Nature because it is instinctive. It is this large class which I refer to to-night; and I beg to offer a few remarks for your indulgent consideration as to the meaning of this strong impulse which impels many people to the study of Natural History.

We may investigate the subject in various ways, such as the following :—

- (1) We may argue from our own experience and analyse our own feelings.
- (2) We may read the lives of great naturalists, and try to find why they took to the study of Natural History.
- (3) We may attempt to ascertain in what kind of character or mental endowment this innate love of Nature is most developed.
- (4) We can endeavour to trace its beginnings in young children.
- (5) We can study questions which bear upon the subject in savage uncivilized nations as representative of primitive man. This will mean, chiefly, the attitude of primitive man to the phenomena of Nature.
- (6) If this is a question of instinct, or of the survival of several primitive instincts, as I believe it to be, we may gain some light by looking at it from the point of view of development.

Now, (1) can we gain any light on the subject from our own experience or that of our friends?

This cannot help us much. People can rarely describe their instincts. Personally, I feel convinced that the impulse I refer to was so strongly developed in me when a boy that it would be absurd to call it other than instinctive. It never took the course that leads a man to become a naturalist, but the initial impulse which I believe to be the origin of the naturalist's life was there. The very thought of wild animals—especially certain kinds of wild animals; the longing for unknown, uninhabited, savage lands; the wish for some weapon such as a gun, or bow and arrow, or even a catapult, wherewith I could try to kill something was certainly as strong as any ordinary kind of religious fervour.

The sarcastic remark, "It is a fine morning, let us go out to kill something," would not then have sounded sarcastic to me. When I ask my friends now about these early feelings they seem reticent, or don't quite understand what I mean. If I press the point, they are rude, and suggest a brain specialist; so I can get little out of them. I shall incidentally refer to this again, perhaps; but will now go on to No. 2, viz. :—*What have the lives of great naturalists to teach us on the subject?*

One is impressed by the intensity of the feelings with which great naturalists appear to regard their favourite study. I say great naturalists because it is only the well-known men, men who have written, from whom we have any record at all; but this by no means shows that the feeling is less intense in others who have never described their feelings. The "sacred fury," however, does not begin as a mere desire to investigate Nature. It frequently takes the form, at first, of a passion for "collecting," especially for collecting difficult or rare objects. This impulse, which certainly often appears to initiate the naturalist's career, has, strictly speaking, little to do with Natural History study. It is a hobby, sometimes almost a craze. If you wish to see how powerful is this instinct you have only to see a boy risking his life after birds' eggs, or see how all feelings of fastidiousness or cleanliness are completely abolished when he is digging out a sexton beetle from underneath a putrid and decaying carcass of a rabbit, or the joy with which a rare slug, or, perhaps, a mouse that has been dead, say, four days, will be put into his pocket where he carries his lunch and his handkerchief.

The great John Hunter possessed this collector's appetite all his life. A letter of his to a friend in Africa illustrates this very well. After requesting the friend to catch some swallows for him, he asks for an ostrich's egg just about to be hatched, with the shell crushed and the whole put in spirit. He then goes on, "If the foal of a camel was put into a tub of spirits and sent, I should be glad. Is it possible to get a young tame lion, or indeed any other beast or bird? If cameleons are sent it should be in the Spring. . . . I want everything respecting the bee tribe, such as wasps with their nests, also hornets with theirs, &c." "The friend in Africa" must have had a busy time if he shipped off this Noah's collection.

Richard Jefferies was a born naturalist, and again and again attempts to describe the chain which bound him to Nature. He was a great sportsman, and probably it was this which first led him to study animals. He has written a graphic account of the first snipe he shot. He says ("The Amateur Poacher," p. 181) "the emotion, for it was more than excitement, of that moment will never pass from memory." He felt the enchantment of animals. In his book called "The Open Air" (p. 126) he gives a description of the effect of the hare upon him, which, he says, "causes quite a different feeling" from rabbits or pheasants, and he attributes this to the fact, amongst others, that it is perfectly wild, unfed, untended, and then he is the largest animal to be shot in the fields." Here you have an example of the attraction of the really wild life, and the sportsman's instinct to kill, leading on insensibly to the loving study of the animal he destroys. Nature appealed to Richard Jefferies in that mysterious manner in which old instincts do appeal. He, like so many others, hears the voice of Pan, "I was utterly alone with the sun and earth," he says in one passage ("The Story of My Heart"), "Lying down on the grass I spoke in my soul to the earth, the sun, the air, and the distant sea . . .

through the grassy couch there came an influence as if I could feel the great earth speaking to me." This, you see, was no reasoning on his part, but something which stirred within the "abysmal depths of his personality" like the voice from an unseen world; and so no doubt it was, the voice of countless generations of ancestors who lived by the chase and who worshipped the great forces of Nature.

One other naturalist, and only one, have I time to refer to; a typical man for my purpose—*Charles Darwin*.

He belonged to a family that produced more than one famous naturalist. His special proclivities may be said, therefore, to be inherited. Then it may be noted, as bearing on my contention, that he gradually, as manhood came on, lost his "æsthetic sense" to a great extent. He was in youth very fond of poetry, also of music, and to some extent was fond of paintings. These senses he almost entirely lost. He never quite lost his delight in fine scenery. He says, "In 1822 a vivid delight in scenery was first awakened in my mind . . . and this has lasted longer than any other æsthetic pleasure." Instincts, as we shall see directly, would naturally be inherited at certain periods of life, to decay afterwards.

In his young days he was passionately fond of shooting. He says, "I do not believe that anyone could have shown more zeal for the most holy cause than I did for shooting birds." He, like Richard Jefferies, talks with rapture of his first snipe. His father once said to him (*Life and Letters*, p. 32, Chap. II.) "You care for nothing but shooting, dogs, and rat-catching, and you will be a disgrace to yourself and all your family." He little realized that this was the strong appeal of instincts which would lead him on to assured fame.

In his "Journal of Researches" (p. 368) he has the following: "It has been said that the love of the chase is an inherent delight in man—a relic of an instinctive passion. If so, I am sure the pleasure of living in the open air, with the sky for a roof and the ground for a table, is part of the same feeling. *It is the savage returning to his wild and native habits.*" Notice that Darwin's first connection with Natural History was his love of sport; then he became a great collector, beginning with beetles, then a traveller into uncivilized countries, where he felt, as the last quotation shows, the true instinctive love for wild scenery, savage primeval man, wild animals and plants, and the open wild life of the woods and plains. He was, as it seems to me, obeying all this time, not the voice of reason, but the strong, imperative call of instinctive feeling, and this was gradually leading him, as it often does in such cases, to a more reasoning investigation of all that gave him so much pleasure; and as his mental faculties grew, his instincts waned; he became more a creature of reason, less a creature of instinct. But with his instincts for the chase, for savage life, for collecting, and so on, he also lost, what I believe are also chiefly at first instinctive, his æsthetic sense; his love for poetry and music; and he became

more and more, as he himself expressed it, a machine for grinding out generalisations from facts.

(3) In what kind of character is this love for Natural History usually developed? This, as I have before said, is not easy to answer, because it is only the eminent men who leave a record behind them. But that it is not confined to those of large mental calibre is pretty certain. I believe it to be quite common amongst all sorts and conditions of men, professional, business, literary, or scientific. It seems to me to be sometimes almost entirely absent—and perhaps more so in the very studious and in the weakly. In young people with the “Society” instinct, it is also apparently often absent; and is, on the whole, strongest in the robust, and in those inclined to field sports, shooting, fishing, &c. Quite feeble-minded people possess it, I believe, as well as the highly intellectual. This would tend to show its instinctive nature; its independence of mental gifts.

(4) *As to its beginnings in young children.* I have already referred to this, but other points may be emphasized. Not only is it true, as Gilbert says:—

“Every boy and every gal
That's born into the world alive,
Is either a little liberal
Or else a little conservative,”

but there is a much deeper and more important distinction mentioned in the first line. The child *must* be either a little girl or a little boy. My point is this:—Their instinctive natures are bound to be very different. Ever since mankind appeared on the earth the man has had to hunt for food, and the woman has looked after domestic arrangements. There have been rare exceptions; but as a rule it has been as I say, and the sure proof of this is found in the different tastes or instincts of the two; the little girl likes her doll and her doll's clothes, and the little boy likes to play at being on a desert island, being attacked by savages, hunting, shooting, and fighting. He also enjoys games in which sudden surprises, jumping out and catching the unwary, &c., form a prominent part. And so it follows that the boy has the first instinctive tendencies to Natural History most strongly marked, and as a matter of fact field Natural History can claim many more male than female followers, partly from the above reason, but partly of course from other more obvious ones which prevent a woman from following the rough and tumble of a naturalist's life. If the little girl loves Nature, as she often does, she arrives at that condition much more by her sense of beauty. She follows Nature, but is not called by her. She travels towards her over the sun-lit hills of reason and love for the beautiful; whereas the boy travels by the dark valleys of instinct, where often cruel spectres haunt him; and in some of these valleys he becomes for the time a savage, and delights to chase and kill anything that will run away from him.

For my purpose, then, we have to deal chiefly with the boy; and no one can doubt that the boy usually has at one period of his

existence the instincts of the wild man ; instincts which prompt him to hunt, to kill, to fight, to keep animals, to love desert and wild places, and so forth. And I maintain that these instincts are the forerunners, and indeed are part and parcel of that love for Nature which is the chief factor in the making of great naturalists, and is, when the sense of beauty and reason are added, one of the highest of all the passions. I have spoken of the effects of animals upon such as have this instinct. I remember, vividly, the extraordinary effect the sight of a weasel had upon me when a small boy ; no other feeling is quite like it. Many, no doubt, of those present to-night heard a great bird naturalist speak, a year or two ago, at the University, and noticed the rapture with which he spoke of a certain owl who used to share his bedroom with him. He also made a remark which struck me ; he said that it was impossible for anyone to be so happy as he had been watching birds in woods and fields near Clifton. I feel sure he was wrong, and that there are hundreds of people who experience the same indescribable pleasure when watching birds and animals ; and do not tell me that this is because the naturalist loves birds and animals and therefore takes an interest in them. It *is* that also, but there is, I am sure, something much more ingrained in our nature which produces these feelings, which, like all instinctive feelings, completely baffle description.

(5) Does the study of primitive races throw any light on the matter ? The savage is not the best person to give us information on abstruse matters ; but we can find out something of his attitude towards Nature. This attitude is certainly one of awe and wonder, often of terror, and mixed with these emotions is, no doubt, the instinctive pleasure that any wild creature finds in that which affords him the means of obtaining food, of feeling pleasant warmth, the refreshing influence of rain, and so forth. Whether an ordinary savage admires Nature, as we do, is a question. Probably not. He feels pleasure in it probably, as a wild beast might, without ever putting it into any form of language. But if a savage worships anything at all, it is the elemental forces of Nature, in which he embodies some good or evil spirit or the souls of his departed ancestors.

Longfellow's poem of "Hiawatha" gives no doubt some more or less correct idea of the view of Nature taken by the North American Indians in their uncorrupted state. Everything is personified ; even the larch tree speaks to Hiawatha and promises him its root and fibres for the making of his boat. The sacred evening star is a bead of wampum on the robes of the Great Spirit. But more reliable sources are at our disposal. In Sir Harry Johnston's book on the Uganda Protectorate there is a great deal of interesting information germane to our subject.

Amongst most of the Uganda tribes ancestor-worship is practised. The spirits of departed chiefs (never the spirits of women, I regret to say) become in some way part of the forces of Nature (p. 752) and haunt trees and rivers, &c. Some African tribes dimly recognize a supreme God or Gods ; and it is interesting to note

that the Nilotic tribes of the Ja-luo call their god by the name of Chieng, which is the word used by them for the sun, and they do homage to the sun by spitting towards the East every morning and towards the West every evening. The Masai worship certain kinds of trees, and regard grass as a sacred symbol (832). Amongst the Bantu negroes rivers are considered to be the homes of spirits, and they recognise rain-spirits; they also employ tree-worship. The Bahinia, a tribe of the Bantu, have a name for God, "though, when questioned, they can only associate the overruling power with the sky, the rain, and the thunder-storm" (631). It is obvious, therefore, that these people look upon the forces of Nature—storms, earthquakes, lightning, &c., and many of the objects around them, such as trees, rivers, &c., as the work of spirits or the home of spirits. Their pantheism is of a crude type; but we can have little idea of their actual feelings owing to the poorness of their language and of their means of expressing what they feel. Poets and philosophers have occasionally attempted to be the spokesmen of the savage's views on religion. Browning's "Caliban upon Setebos" will occur to you. You no doubt remember how he looks upon the raven as a messenger who informs the god of poor Caliban's talk and sends his thunder and lightning to follow up the criminal. Such views are by no means confined to savage nations; but as knowledge increases the form of the religion becomes more exalted; but the terrible forces of Nature are still either spirits or are the direct weapons of the deity. The Rev. Smythe Palmer ("Nineteenth Century," October, 1909) says that the Jews believed that the God of the Firmament rode forth on the four winds of heaven, personified by Cherubim; and the Seraphim, according to the same authority, are the lightning flashes wriggling like fiery serpents before the throne of the Eternal. Many passages in the Old Testament suggesting this will occur to you (Psalms civ., 3-4, "He maketh the clouds his chariots," &c.) as in Milton's "Paradise Lost." There is reason to think that our Saxon ancestors associated hills and rivers with certain spirits. Now all this has a very important bearing upon our subject. If we inherit the physical frames of our ancestors, and even inherit for a time, especially in our pre-natal development (which I shall refer to directly), certain peculiarities of those remote ancestors from whom we have widely diverged—if this is true, can we escape the corollary that we must inherit also their instincts, and even, perhaps, the general trend of their religious beliefs? And one of the strongest and most universal beliefs of primitive man, and one that has come down, modified, but the same in principle, to many modern nations, is the spiritual essence of the various phenomena produced by the great forces of Nature. So that when we feel those powerful and inexplicable feelings which draw us so strongly to Nature, are we not really listening to those old instincts and beliefs which have been for thousands of generations impressed upon every fibre of our being?

You may be sure that many a man, besides the poet, has heard in solitude the "horns of elf-land faintly blowing," and the

pine tree "talking to the wind with whistling breath," and "the dark cedar sighing for Lebanon."

(6) Finally, cannot we study this question developmentally?

This is a difficult matter, and you must not be surprised if I fail to make my meaning clear. If you do not understand me you must credit me with some profound thought.

I must, to begin with, take it for granted that whatever view we may hold of our origin, we believe at all events that many "thousands of ages have gone to the moulding of man." That whatever cycles Nature has gone through, these cycles represent enormous periods of time. Now, from our birth onwards we slowly develop and change. The man is not merely a large child, he is a different creature, especially in his instincts and mental endowments. Shakespere has told us this in his seven ages of man.

But *before* birth the development is a hundred times more rapid. There is pre-natal and post-natal development, and in the former events are crowded together one after the other so rapidly that the thing becomes miraculous. Think for a moment of the development of a chick before it leaves the egg, and remember that the same changes, or very nearly the same, go on in our own embryonic bodies. At first the future chick is a collection of cells; then at the appointed time some of these cells form a little heart and begin to beat, others form the nervous system, and so on. But the development does not go on in quite the manner one might expect. At certain stages one sees before one a very peculiar creature, which might be turning into a fish, for it surely is going to develop gills. Then there is a longish curved tail and four limbs, which might become parts of a four-legged creature. What do all these mean. They mean that the future chick is reproducing, in little, some of the peculiarities, not of its parents, but of its remote ancestors. Nor does this entirely cease at birth. But if man (like the chick) in his physical development inherits at different stages the stamp of his ancestry, does it not follow that he must also inherit the stamp of their instincts? These instincts can only show themselves after birth; and no one can doubt, I think, who has watched the growth of children, that they go through fairly sharply marked-off phases in their instinctive and mental development, very much as they do in their physical. The baby has the instinct to get food; it knows at once how to take it, and is quite clever at it. The young child has also the food instinct predominant, but it loves to play, and takes delight in moving its muscles and looking after itself generally. It is at first entirely selfish. The boy especially develops the ancestral instincts of chasing anything that will run away from him, the love of fighting and fighting games, and especially the love for animals. When he begins to read, if his mind is healthy, he likes books of adventures in wild, uncivilized lands, escapes from savages; shooting, hunting, &c. His fighting instinct may take the form of real fighting or rough, struggling games. During the period when these

instincts are dominant, he is more or less possessed by them ; and as there is no room for feelings of gentleness and pity he is often wrongly accused of cruelty. But these instincts frequently lead him irresistibly to the study of Natural History. As manhood comes on they often die away or are only occasionally revived. Reason becomes more prominent and instinctive life dwindles. But the love of Nature of the kind I am speaking of to-night is most marked in boyhood and youth. It is only too evident that however much we may reverence and admire the works of Nature, in manhood, the real passion begins early in life, and tends to decay as the years bring their inevitable changes.

Development shows us, in fact, that a deep impression is made on our physical frames by the forms of animal life through which we have been evolved ; the body *remembers* these changes. We may therefore infer that our nervous systems are also deeply impressed by the changes through which *they* have evolved, and in the same way remember these changes, however much they may appear to be forgotten. Nature-worship, early savage beliefs and superstitions, hunting, associations connected with the chase and in the killing of prey for food, nocturnal habits, and many other forgotten impressions are revived in us at certain times in our life, and constitute, in my opinion, that mysterious love of nature which is in many people a great compelling force, connected with feelings which are incorporated with our very being.

Real love of Nature, therefore, is, I say, like love of poetry, an instinct, and is innate. You may encourage it, develop it, nurture it, but you cannot make it, and it is never acquired.

I said "like poetry ;" and before ending this paper I should like to say a word or two on this point. It is difficult to separate the love of Nature as I have endeavoured to describe it to-night from the love of Nature which is so strong in many great poets. Indeed, one may go further, I think, and say that the real poetic instinct, meaning by that the innate love of and power of appreciating good poetry, are very similar. Both are in-born, neither can be acquired ; both develop early in life and tend to diminish as years pass by in most cases. Both are found independently of any special kind of mental endowment, and both, I believe, are intimately bound up with primary instincts. To both, except amongst the lucky few, may be applied the lines of Wordsworth :—

"The youth who daily further from the East
Must travel, still is Nature's priest,
And by the vision splendid
Is on his way attended ;
At length the man perceives it die away
And fade into the light of common day."

In conclusion, it might be urged that any attempt to show that such high feelings as the love for Nature and the love for poetry are instincts derived from lower grades of ancestors is sacrilegious and debasing. But I think, on the contrary, that such an explanation rather ennobles than demeans. The power of reason is a glory to man, but our instincts are equally the result of the

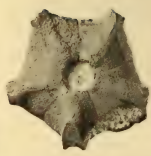
great power which tends to perfection, and if lower than reason are also in some respects higher. They, at least, are beyond any question of right or wrong; they have been fashioned during untold ages in the great workshop of Nature, and are part of our very being. If this appeal to us is, as I believe it to be, a voice echoing from dim, forgotten ages during which the foundations of our destiny were being laid, one can, more than ever, exclaim with Carlyle, "Welcome, thou great Nature! Savage, but not unkind, unmotherly; sing thou to me, O mother, thy mystic everlasting lullaby-song, and let all the rest be far."



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OROPHOCRINUS AND ACENTROTREMITES.

Two Blastoids (*Orophocrinus* and *Acentrotremites*) from Somerset.

By F. A. BATHER, M.A., D.Sc., F.R.S.

(With Plate.)

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TWO Blastoids, recently found by Mr. J. T. Underhill and Mr. J. W. Tutchter, of Bristol, and submitted to me for examination through the courtesy of the latter gentleman, proved of such interest that, through the generosity of their respective discoverers, they are to be preserved in the national collection. Mr. Tutchter has added to his kindness by preparing some of the illustrations to the present note.

Orophocrinus orbignyanus (De Koninck).

(PLATE, figs. 1 and 2.)

For references to literature see "List of the genera and species of Blastoidea," British Museum, 1899.

The specimen [Brit. Mus. E. 8255] comes from the Tournaisian *Zaphrentis* zone of the Carboniferous Limestone at Waterlip, near Shepton Mallet, Somerset. The type-specimen and all other known specimens are from the Tournaisian of Tournai. The species has not hitherto been found in England, nor has it, so far as I am aware, been recorded outside Belgium.

The specimen consists of a complete theca, lying beside a piece of stem on grey limestone matrix (Fig. 1). In general shape the theca resembles that figured by Etheridge & Carpenter, 1886 (Cat. Blastoidea, Brit. Mus., pl. xiv. ff. 16, 17), but is rather more elongate. The holotype, on the evidence of the original figure (1842), is less elongate even than Etheridge & Carpenter's figure, and further differs in the concave curvature of its sides. The same features are seen in the figures published by De Koninck & Le Hon (1854), though the curvature is less marked in their enlarged figure 5 b. Since the latter authors said that only one complete specimen was known to them, their figures and those originally published by De Koninck (1842) must all represent that specimen. The holotype was said by De Koninck & Le Hon to be at the Ecole des Mines, Paris, and without seeing it one cannot of course say which figure is most correct. The same uncertainty attaches to the measurements, which differ from statement to statement and from figure to figure. The specimen figured by Etheridge & Carpenter was said by them to belong to the University of Liège, and was therefore not the holotype.

The base of the holotype is described as hollowed and as sub-trigonal. The latter feature may be also expressed by saying that each basal has a slight keel at its proximal end. Both of these features are very faint in the English specimen, and in this

respect the specimen figured by Etheridge & Carpenter seems to agree with it rather than with the holotype. The trigonal section of the base is equally indistinct in the only Belgian specimen possessed by the British Museum [E. 8239], a slightly crushed theca from Tournai.

The measurements in millimetres, so far as they can be ascertained, are :—

	Waterlip	De Kon. Figure of Holotype.	Figg. of De Kon. & Le Hon.	Statement of De Kon. & Le Hon.	Eth. and Carp.	B.M. E. 8239.
Height of theca	14·2	14·0	15·5	17·0	10·0	ca 9·0
Antero- posterior dia. }	8·2	?	11·8		7·3	7·2
Transverse diameter }	ca 7·3	10·5	{ 14·0 or 12·4 }	10·0	8·5	7·5
Diameter at proximal end }	3·4	1·4	3·2		2·1	2·7

The ratio of height to diameter appears so much greater in the English specimen that one is almost tempted to regard it as at least a new variety. But it would be rash to take any such step on so insecure a foundation as the self-contradictory figures and statements hitherto published.

The piece of stem appears from its position to be the proximal region of the stem belonging to this theca ; but closer examination shows this to be unlikely. It seems to be a single columnal, 7·4 mm. long, with a diameter of 3·7 mm., that is to say slightly exceeding the proximal diameter of the theca. Both joint-faces are flat, and marked with fine ridges radiating from a lumen of 9 mm. diameter, and undoubtedly larger than the lumen at the base of the theca.

Acentrotremites ellipticus (Cumberland).

(PLATE, figs. 3—7.)

For references to literature see "List of the genera and species of Blastoidea," British Museum, 1899.

The specimen [Brit. Mus., E. 8256] comes from the Viséan *Dibunophyllum* (D 2) zone of the Carboniferous Limestone at Wrington, Somerset, and is coloured dark red outside (Figs 3-5). The holotype has disappeared and its provenance is uncertain. The specimen figured by Etheridge & Carpenter [Brit. Mus., E. 782] is labelled "Carboniferous Limestone, Somerset," and is coloured like that from Wrington (Figs. 6 and 7). The fact that Cumberland described his specimen as consisting "of perfectly white limestone, filled with brown calcareous crystals," does not necessarily militate against its having come from the same stratum as those now before me, for their red colouring, though characteristic of the *Dibunophyllum* beds, is superficial, and Cumberland's words apply absolutely to specimen E. 782 ; the substance of the plates is white calcite. The Wrington specimen confirms the view that Somerset is the home of "*Mitra elliptica*," and first makes certain the horizon of the species.

The specimen consists of an almost perfect theca, about two-thirds the size (in linear measurements) of E. 782 and of the holotype, which agree somewhat remarkably in this respect.

Comparing it with the description by Etheridge & Carpenter, we note—

The theca tends to be dome-shaped rather than “elliptical” or “tapering upwards,” that feature in E. 782 being in fact more apparent than real, and due partly to crushing, partly to fracture.

Base rather convex than “concave” (Fig. 4). There is a central concavity of circular outline and 5.3 mm. diameter (about 6 mm. in E. 782). From this rounded ridges radiate to the lips of the radial sinuses, these ridges widening so as to meet round the central concavity, contracting at about two-thirds the distance, and then expanding again towards the sinus. This structure is also more visible in E. 782 than one would gather from Etheridge & Carpenter, pl. xiii., f. 17, though somewhat obscured by weathering and perhaps by old age. The outline of the basal concavity in that figure should be elliptical, with its long axis in a line with the left posterior perradius (SE. in figure).

The summit is flattened, depressed, even slightly concave. So far as I can see, it was flattened in E. 782, not “rounded.” What Etheridge & Carpenter meant by “sometimes contracted” is not clear, for they had only one specimen.

“Periphery,” *i.e.*, level of greatest diameter, passes through the lips of the radial sinuses, and this was probably also the case in E. 782, and is presumably what Etheridge & Carpenter meant to express. The transverse section is concavi-stellate, and was probably so in E. 782, not “distinctly pentagonal.”

The basal plates are entirely within the basal concavity. In both specimens I have removed some of the calcite infilling, *not* “the remains of the upper stem-joints,” and so exposed a portion of the basals. Their upper angles come very close to the margin of the concavity.

The lip of the radial sinus is prominent and rounded, and extends on each side about half-way up the limb of the radial as a raised rounded margin.

The deltoids are meridionally depressed by a broad V-shaped furrow. Since the posterior deltoid is nearly twice the width of the others (4.9 mm. : 2.9 mm.) this furrow in it appears shallower. This furrow is to be seen in the right posterior deltoid of E. 782; in the posterior and left posterior deltoids it is obscured by crushing. In this specimen the posterior deltoid is not so much wider than the others (5.6 mm. : 4.3 mm.).

The spiracles are pyriform, rather than “ovate-oblong,” with the thinner pointed end directed upwards and inclined towards the perradius; those adjoining the anal deltoid are narrower than the others. Those of E. 782 were probably similar.

There is no direct evidence as to the size of the column in either specimen

Though the finer ornament is not preserved, both specimens show marked ridges or growth-lines parallel to the inter-radial sutures.

In the "Treatise on Zoology," 1900, p. 90, f. XIII., I have already published an account of the subvective skeleton more complete than that given by Etheridge & Carpenter, but based on the same specimen E. 782. It should here be added that the "ambulacrum," which throws most light on this structure, and which Etheridge & Carpenter profess to represent in their plate xiii., f. 19, is not the right posterior as there indicated, but the left anterior (Fig. 7). The Wrington specimen throws no further light on the subject; it is too well preserved.

Comparative measurements, in millimetres, are :—

		Wrington.	E. 782.
Height from base-plane		19'4	29'8
Greatest diameter		23'2	30'5
Diameter of basal concavity		5'0	6'0

EXPLANATION OF PLATE.

Orophocrinus orbignyanus

[E.8255]

- Fig. 1. Theca viewed from left posterior radius; $\times 3$ diam.
 Fig. 2. Theca viewed from oral surface, the anal opening being next the observer; $\times 3$ diam.

Acentrotremites ellipticus

[E.8256]

- Fig. 3. Theca viewed from posterior interradius; nat. size.
 Fig. 4. Theca viewed from below, the anal opening being away from the observer; nat. size.
 Fig. 5. Theca viewed from above, the anal opening being next the observer; $\times 2$ diam.

[E.782]

- Fig. 6. Theca from right posterior interradius, nat. size.
 Fig. 7. Theca from left anterior radius, showing the structure of the ambulacrum, with its side-plates (*s.p.*), outer side-plates (*o.s.p.*), lancet-plate (*L*), and hydrospire-plates (*h.p.*); $\times 2$ diam.

Figs. 1—5 are from photographs by Mr. J. W. Tutchter;
 figs. 6, 7 from photographs by Mr. H. G. Herring.

The Diptera of the Bristol District.

By H. J. CHARBONNIER

(Hon. Member of the Bristol Naturalists' Society).

THE following notes are intended as a help towards a list of the Diptera of the district, but owing to the immense number of species and the paucity of observers it is impossible to give anything like a complete list at present, indeed some families are hardly represented in these notes. Records are given of 690 species.

The notes almost all refer to a district lying between Wotton-under-Edge on the North and Shepton Mallet on the South.

I have to acknowledge the great help I have derived from notes given me by V. R. Perkins, Esq., relating to the Wotton-under-Edge district, and also from my late friend, C. J. Watkins, of Painswick. I have also noted a few species reported by Colonel L. Blathwayt in the Victoria History of Somerset, and by G. H. Verrall in his two beautiful volumes of "British Flies."

Owing to there being so few observers it is impossible to say anything about 'distribution.' Most flies do not seem to wander far from the spot where they are hatched, but given suitable conditions, larval food, &c., they may be expected to turn up anywhere within the district, if looked for at the right time.

The life histories of many species are not known, and Diptera are mostly very difficult to rear.

The collections of flies which formed the basis for these notes are now in the Museums at Bristol and Taunton. Short notes relating to life histories, or aids to identification, are added in many cases.

The best handbook I know is the Rev. W. J. Wingates' *List of Durham Diptera* (1906) (Williams & Norgate). This gives tables of the species as well as plates and useful hints on structure, collecting, &c.

It is quite impossible for one collector to work all the groups, for any serious work one is obliged to specialize, as the Rev. E. A. Eaton has done for the Psychodidæ and Dr. John H. Wood for the Phoridae.

Throughout these notes S.M. means that I have found the species at Shepton Mallet, V.R.P. means that the species is reported by Mr. V. R. Perkins from the Wotton-under-Edge neighbourhood, and C.J.W. means reported from Painswick by Mr. C. J. Watkins.

SECTION I.—NEMATOCERA.

PULICIDÆ—The fleas. I can only record 5 out of some 30 species.

Pulex irritans (L.) Far too common everywhere.

„ *canis* (Curt) On dogs } common everywhere.

„ *felis* (Bouché) On cats }

„ *goniocephalus* (Tasch) V.R.P. Common on rabbits.

Ctenopsyllus musculi (Dugés) S.M. On house mice.

CECIDOMYIDÆ—The Gall Gnats. Beautiful little gnats with long verticillate antennæ and delicate, minutely-hairy wings. The larvæ live in vegetable galls. Asexual reproduction has been observed in some species.

Cecidomyia destructor (Say) V.R.P. This is the notorious Hessian fly of wheat.

- „ *nigra* (Mg.) C.J.W. Bred from young pears.
- „ *brassicæ* (Winn.) S.M. Common, forms swellings on cabbage and turnip.
- „ *urticæ* (Perris) Forms galls on nettles. Common.
- „ *curvaria* (Bremi) Galls on leaves of Ground Ivy. Common.
- „ *veronicæ* (Vallot) V.R.P. Gall on stems of *Veronica*.
- „ *crategi* (Wtz.) Bristol. Common, on shoots of Hawthorn.
- „ *galii* (Lw.) V.R.P. On stems of *Galium*.
- „ *persicariæ* (L.) Bristol. On leaves of *Polygonum*.
- „ *serotina* (Winn.) V.R.P. On shoots of *Hypericum*.
- „ *tiliæ* (Schr.) Bristol. Common, on shoots of Lime.
- „ *ulmaricæ* (Bremi) Common, under leaves of *Spirea ulmaria*.

Diplosis tritici (Kirby) C.J.W. The Wheat-midge.

- „ *callida* (Wtz.) V.R.P. In seed capsules of Poppies.

Hormomyia fagi (Hart) V.R.P. On Beech.

- „ *corni* (Gir.) Leigh Woods, on leaves of Cornel.

Epidosis longipes (Lw.) V.R.P.

Asphondylia genistæ (Lw.) Bristol. Galls on *Genista tinctoria*.

Lasioptera rubi (Schr.) Bristol. From galls on *Rubus*, emerge in May.

MYCETOPHILIDÆ—The fungus-gnats. Graceful little gnats with spurs on their legs; the veins of the wings are more elaborate than in the Cecidomyidæ, the wings are rarely hairy. Some appear in winter, many hibernate in hollow stems of Umbelliferæ, &c. Larvæ in fungi or decaying vegetation.

Sciara thomæ (L.) S.M. In May.

- „ *carbonaria* (Mg.) Bristol. May.

- „ *morio* (F.) S.M. May.

- „ *præcox* (Mg.) V.R.P.

- „ *pulicaria* (Mg.) Bristol. In February. Larvæ in rotten wood.

Epidapus scabiei (A. D. Hopkins). This minute gnat has a wingless female, and two forms of the male, one small-winged and one large-winged. I bred these from decaying *Narcissus* bulbs at Clifton. The males are much more numerous than the females. The only previous record or description of this insect is given by Mr. A. D. Hopkins,¹ who found them in potatoes, “causing something like potato scale.” Mine were in bulbs attacked by

¹ Proc. Ent. Soc. Washington, Vol. III., p. 149.

larvæ of *Merodon*, the resulting decay in the bulb affording the food of the larvæ. I should be inclined to think that in the case of the potato, there is some disease (fungoid?) which causes the tuber to decay, and so prepares it for *Epidapus*.

Zygoneura sciarina (Mg.) Bristol. June.

Mycetophila punctata (Mg.) S.M. July.

„ *lineola* (Mg.) S.M. April.

„ *nigritula* (Wlk.) V.R.P.

Rhymosia fenestralis (Mg.) C.J.W.

„ *fasciata* (Mg.) C.J.W.

Exechia fungorum (Dg.) S.M. February.

„ *lateralis* (Mg.) C.J.W.

Allodia crassicornis (Stan.) S.M. February. Have often found these hibernating in caves, &c.

Sciophila fasciata (Zett.) V.R.P.

Platyura marginata (Mg.) V.R.P.

Ceroplastes tipuloides (F.) S.M. July.

Macrocera centralis (Mg.) S.M. June. These beautiful little gnats may be known by their immensely long thread-like antennæ; they are sometimes quite common.

„ *lutea* (Mg.) C.J.W. and V.R.P.

„ *vittata* (Mg.) V.R.P.

„ *angulata* (Mg.) V.R.P.

„ *stigma* (Curt.) V.R.P.

Plesiastina annulata (Mg.) V.R.P.

BIBIONIDÆ—Medium sized, black, hairy flies, seen in spring, sometimes in immense numbers. The males dance up and down in the air. The larvæ live in decaying vegetation.

Scatopse notata (L.) S.M. April. C.J.W. Bred from a wasp's nest.

„ *scutellata* (Lw.) V.R.P.

„ *flavicollis* (Mg.) V.R.P.

Scatopse is a genus of small, shining, mostly black, flies; the females are sometimes found congregated in numbers under bark.

Dilophus febrilis (L.) S.M. Very common. Bred from larvæ living in cow-dung.

„ *albipennis* (Mg.) S.M. May.

„ *femoratus* (Mg.) S.M. June.

These are small, black, hairy flies; the larvæ are said to be sometimes very injurious to hops. These three are all the British species.

Bibio marci (L.) St. Mark's fly. Common everywhere in April.

„ *pomonæ* (F.) V.R.P.

„ *hortulanus* (L.) V.R.P.

„ *johannis* (L.) St. John's fly. (S.M.) Common in May.

„ *clavipes* (Mg.) Throughout the district.

„ *nigriventris* (Hal.) V.R.P.

„ *leucopterus* (Mg.) S.M. and V.R.P.

Bibio ferruginatus (Gmel.) V.R.P.

„ *venosus* (Mg.) S.M., May, and V.R.P.

„ *laniger* (Mg.) Leigh Woods. May.

The sexes are very different in *Bibio*, and the eyes are very hairy. There are 15 British species.

SIMULIDÆ—Sand flies. Very small, hairy, black flies. Sometimes very abundant, and a great nuisance from the females' biting habits. The larvæ live in the stems of water plants. The males fly in circles in the air. Often found in cold weather. C. J. W. has found them in numbers on the ears of horses.

Simulium reptans (L.) S.M. March.

„ *ornatum* (Mg.) Stonehouse. June.

CHIRONOMIDÆ—'Midges' that *do not* bite. The males have beautifully feathered antennæ. Sometimes seen in clouds by the water side. The larvæ are mostly aquatic, the 'bloodworms' seen on the mud in ponds are some of them; a few live in earth or dung. The species are very numerous, over 300 have been described. Asexual reproduction has been observed in some species. The eggs are imbedded in long, gelatinous masses.

Corynoneura minuta (Winn.) S.M. A very minute, black midge.

Chironomus plumosus (L.) Common throughout the district. A large and handsome midge, half-an-inch long.

„ *pallens* (Mg.) Taunton. May.

„ *virescens* (Mg.) Nempnett, by the lake, in immense swarms.

„ *dorsalis* (Mg.) V.R.P.

„ *pedellus* (Drg.) V.R.P.

„ *pedestris* (Mg.) V.R.P.

„ *albimanus* (Mg.) S.M. May. Distinguished by the white metatarsi.

Cricotopus annulipes (Mg.) S.M., April, also V.R.P.

„ *bicinctus* (Mg.) S.M. September.

This is a genus of delicate, fairy-like midges, the males with beautifully plumose antennæ, and the legs largely barred with white.

Orthocladius variabilis (Staeg.) S.M. February.

„ *notatus* (Mg.) S.M. April.

Camptocladius aterrimus (Mg.) Tiny black midges that occur in great numbers in the coldest weather. Common everywhere.

Metriocnemus fuscipes (Mg.) Redland. April.

„ *co-equatus* (Mg.) V.R.P.

Tanytus varius (F.) S.M., April, and V.R.P.

„ *nebulosus* (Mg.) S.M. August.

„ *choreus* (Mg.) S.M. May.

„ *punctatus* (F.) Bitton. July.

„ *punctipennis* (Mg.) V.R.P.

„ *feruginecollis* (Mg.) S.M. September.

This genus is composed of very delicate midges, with, generally, spotted, pubescent wings, which are very short, being not nearly as long as the body. The males have fine plumes to their antennæ. They sometimes swarm near water.

*Ceratopogon*¹ *rostratus* (Wtz.)

„ *varius* (Wtz.) V.R.P.

„ *pulicarius* (L.) S.M., September, and C.J.W. bred it from larvæ in a decayed cherry tree.

„ *femoratus* (F.) Nailsea. June.

PSYCHODIDÆ—Beautiful little flies often seen on windows; they have broad wings, which they carry sloping roof-wise over their backs, and which are very hairy; they have long verticillate antennæ. The Rev. E. A. Eaton, M.A., F.E.S., describes² thirty species from Somerset.

Pychoda sexpunctata (Curt.) Bristol, also C.J.W.

„ *phalenoides* (L.) Clifton. March.

Pericoma nubila (Mg.) S.M. April.

CULICIDÆ—Gnats, that are often called ‘Mosquitos.’ From their biting habits, and from being responsible for the spread of malaria, they have attained notoriety; only the females however bite; the males, recognised by their beautiful plumose antennæ, do not. The larvæ and pupæ are aquatic, and swarm in pools and cisterns. The females hibernate in cupboards, hollow trees, or caves.

Culex annulatus (Schr.) S.M. and Nailsea. November.

„ *nemorosus* (Mg.) Nailsea. July.

„ *pipiens* (L.) Common everywhere.

„ *ornatus* (Mg.) V.R.P.

Corethra plumicornis (F.) S.M. Frenchay, &c. The larvæ is quite translucent, and looks like a tiny glass rod in the water.

Anopheles maculipennis (Mg.) S.M. December.

„ *bifurcatus* (L.) S.M., August; Freshford, May.

PTYCHOPTERIDÆ—Fair-sized gnats, mostly having spotted wings, and whose larvæ and pupæ, which have a long hair-like breathing tube, inhabit shallow pools.

Ptychoptera contaminata (L.) S.M. June, also V.R.P.

„ *lacustris* (Mg.) Lynmouth. June.

„ *albimana* (F.) S.M. June, also V.P.R.

„ *scutellaris* (Mg.) Near Gloster. C.J.W.

„ *paludosa* (Mg.) S.M. May.

These are all the British species.

¹ This genus *Ceratopogon* seems out of place among the Chironomidæ, for their larvæ are quite different, and inhabit manure heaps. I believe *Ceratopogon rostratus* is parasitic as I have observed a number of these insects flying over a beetle, *Meloe proscarabæus*, and occasionally alighting upon it. They often appear in swarms, and the females bite.

² Synopsis of the Psychodidæ, Entomol. Month. Mag., 1893.

LIMNOBIIDÆ—Very long, thin-legged gnats, with a somewhat elaborate wing-veining. Some of them when standing at rest have the curious habit of vibrating the body up and down rapidly. Some of the larvæ are aquatic, some live in plants. This family includes a very large number of genera and species.

Limnobia quadrinotata (Mg.) V.R.P.

„ *nubeculosa* (Mg.) S.M. February.

„ *flavipes* (F.) S.M. May and C.J.W.

„ *tripunctata* (F.) V.R.P.

„ *macrostigma* (Schum.) V.R.P.

Dicranomyia æquosa (Verr.) S.M. April.

„ *lutea* (Mg.) Bristol. August.

„ *chorea* (Mg.) S.M. May, very common. V.R.P.

Acyphona maculata (Mg.) V.R.P.

Molophilus obscurus (Mg.) V.R.P.

Rhypholophus lineatus (Mg.) S.M. April.

„ *nodulosus* (Mg.) S.M. September, and also V.R.P.

„ *similis* (Staeg.) Cheddar. July.

Erioptera flavescens (Mg.) V.R.P. Stonehouse

„ *macrothralma* (Lw.) S.M. May.

„ *tænionota* (Mg.) V.R.P.

„ *trivialis* (Mg.) S.M. May.

Erioptera has conspicuously hairy wings.

Lipsothrix errans (Wlk.) V.R.P.

Pæcilostola punctata (Schr.) V.R.P. and C.J.W.

Limnophila lineola (Mg.) V.R.P.

Trichocera annulata (Mg.) S.M. January.

„ *hiemalis* (Deg.) Common everywhere in Winter.

„ *fuscata* (Mg.) S.M. February.

„ *regelationis* (L.) S.M. Very common; have bred it from rotten turnips.

These are the “Winter Gnats,” occurring in the coldest weather.

Dicranota bimaculata (Schum.) S.M. May.

Amalopis littoralis (Mg.) Lynmouth. June. A large yellow species that probably occurs on the North Somerset coast.

Pedicia rivosa (L.) V.R.P. Kilcot, Gloucestershire. Larvæ aquatic.

TIPULIDÆ—Crane-flies or ‘daddy-long-legs.’ Larvæ live in the earth, and sometimes devastate crops.

Dictenidia bimaculata (L.) V.R.P.

Pacchyrrhina hystrio (F.) S.M. July.

„ *maculosa* (Mg.) Redland. July and V.R.P.

„ *cornicina* (L.) R.V.P.

„ *quadrifaria* (Mg.) S.M. July.

Rather small crane-flies, mostly yellow, with distinct black markings. Larvæ occur in decaying wood.

Tipula gigantea (Schr.) Freshford. June and V.R.P. Our largest dipteron.

„ *rufina* (Mg.) S.M. May and V.R.P.

„ *scripta* (Mg.) S.M. September and V.R.P.

„ *hortensis* (Mg.) Lynmouth. June.

„ *hortulanus* (Mg.) V.R.P.

„ *marmorata* (Mg.) S.M. June and V.R.P.

„ *vernalis* (Mg.) S.M. Very common.

„ *lateralis* (Mg.) Bitton. April and V.R.P.

„ *oleracea* (L.) Very common everywhere, and a great plague.

„ *paludosa* (Mg.) Bitton, common. S.M., very common.

„ *ochracea* (Mg.) V.R.P.

Xiphura nigricornis (Mg.) V.R.P. and Stroud C.J.W.

Ctenophora pectinicornis (L.) V.R.P. Distinguished by the beautiful comb-like antennæ of the male.

RHYPHIDÆ—Small, rather gnat-like flies with spotted wings, common on windows. The males often perform aerial dances in summer evenings.

Rhyphus fenestralis (Scop.) S.M. Common (wings spotted to the tip).

„ *punctatus* (F.) S.M. Common (wings clear at the tip).

SECTION II.—BRACHYCERA.

STRATIOMYIDÆ—Small to large flies, many have brilliant metallic colours.

Chloromyia formosa (Scop.) S.M. I have found the larvæ in a hollow bean stalk.

Chorisops tibialis (Mg.) C.J.W. and Batheaston (Blathwayt).

Pachygaster atra (Panz.) V.R.P. and Langport (Dale).

„ *leachii* (Curt.) Bristol, in the garden of the University, August; also Wincanton (Verrall).

Nemotelus pantherinus (L.) Stroud (Wainwright).

„ *uliginosus* (L.) Minehead (Blathwayt).

Oxycera formosa (Mg.) V.R.P.

„ *pulchella* (Mg.) Batheaston (Blathwayt).

„ *trilineata* (F.) Puddimore-Milton.

Stratiomys chumæleon (L.) Highbridge and S.M., also V.R.P. Handsome black and orange flies; the larvæ live in water, and both larvæ and pupæ have a long anal breathing tube.

„ *riparia* (Mg.) Wellington (Blathwayt).

„ *furcata* (F.) Burnham (Blathwayt).

„ *potamida* (Mg.) Ashley Down, Bristol, and C.J.W.

Odontomyia viridula (F.) Minehead (Blathwayt).

Chrysonotus bipunctatus (Scop.) V.R.P. and Batheaston (Blathwayt).

- Sargus flavipes* (Mg.) September, S.M., also V.R.P.
 „ *cuprarius* (L.) V.R.P., Batheaston (Blathwayt).
 „ *irridiatus* (Scop.) S.M., June. Sometimes common.
 „ *bipunctatus* (Scop.) Bristol, September. Shepton-Montagu (Verrall).
Microchrysa polita (L.) A brilliantly green little fly, common in gardens.
 „ *flavicornis* (Mg.) C.J.W.
Beris clavipes (L.) V.R.P.
 „ *vallata* (Forst.) S.M. and Redland, July to October. Have bred the fly from larvæ in decayed Narcissus bulb.
 „ *chalybiata* (Forst.) S.M., May to July.
 „ *morrisii* (Dale) Has occurred at Porlock (Verrall).
 Metallic little flies, with 6 to 8 spines on the scutellum. *B. vallata* closely mimics a Sawfly.

TABANIDÆ—The Gadflies; the females are bloodsuckers. The larvæ occur in rotten wood or leaves, some are predaceous.

Hæmatopota pluvialis (L.) 'The Cleg'; the females are too common everywhere: the males, easily distinguished by the eyes meeting on the front of the head, are very rare; they are said to dance in the air early in the morning.

Theriopectes micans (Mg.) Wellington (Blathwayt).
 „ *tropicus* (Mg.) Freshford, July, and Shapwick, May, also V.R.P.

Atylotus fulvus (Mg.) Wellington (Blathwayt).

Tabanus bovinus (L.) V.R.P. and Wellington (Blathwayt).

„ *sudeticus* (Zett.) V.R.P.

„ *autumnalis* (L.) Redland, July, and V.R.P.

„ *bromius* (L.) Leigh Woods, August, and V.R.P.

Chrysops cæcutiens (L.) S.M., August, and V.R.P.

„ *relicta* (Mg.) V.R.P.

In life these Gadflies have most beautiful golden eyes.

LEPTIDÆ—Long legged, rather slender flies, medium sized to large.

Leptis scolopacea (L.) S.M. and Cheddar, May. I have found the transparent-looking larvæ in damp moss in December; they pupated at the beginning of May, and are said to feed on earthworms. The wings of this species are spotted.

„ *tringaria* (L.) S.M. Common. Var. *nigriventris* at Cheddar.

„ *lineola* (F.) S.M., July, rare, also V.R.P.

Chrysopilus cristatus (Verr.) S.M. Fairly common.

„ *aureus* (Mg.) S.M., August, rare, also V.R.P.

Atherix ibis (F.) Freshford, June, rare. The females unite in masses hanging over the water.

Xylophagus ater (F.) Leigh Woods. Very rare.

ASILIDÆ—The Hawk-flies : large flies that prey on other insects. Some of the larvæ prey on other larvæ.

Leptogaster cylindricus (Deg.) Filton and Freshford. June. Sometimes in numbers among mowing grass.

Dioctria reinhardi (W.) Neighbourhood of Bristol (Verrall).

„ *atricapilla* (Mg.) Freshford, June, and V.R.P.

„ *ælandica* (L.) V.R.P. I have taken it in North Devon.

„ *rufipes* (Deg.) Common throughout the district.

„ *flavipes* (Mg.) Taunton in August.

„ *linearis* (F.) Somersetshire (Verrall).

Isopogon brevirostris (Mg.) Withycombe (Slater), also C.J.W.

Asilus crabroniformis (L.) Shirehampton in August, also V.R.P.

The so called 'Hornet-fly,' a large, black and yellow and very shiny fly.

Dysmachus trigonus (Mg.) Bitton in May. Rare.

Machimus atricapillus (Fln.) S.M., August, and C.J.W.

Philonicus albiceps (Mg.) Leigh Woods and Henbury in September.

Epitriptus cingulatus (F.) Taunton in August.

BOMBYLIDÆ—Beautiful bee-like flies, with velvety bodies and long probosces. Seen in spring hovering over the flowers.

Bombylius discolor (Mik.) S.M. and Keynsham in March and April.

„ *major* (L.) S.M. from March to as late as June 18th, both these species are fairly common in spring.

„ *canescens* (Mik.) Very rare. Have seen it at Hanham and in North Devon in June. Brockley (C. Bartlett).

„ *minor* (L.) Minehead (Blathwayt), and V.R.P., the latter record was possibly of *B. canescens*.

THEREVIDÆ—Black and grey flies that fly in hot sunshine, and often alight on a dusty path. Larvæ occur in decayed tree trunks.

Thereva nobilitata (F.) Freshford, May.

„ *plebia* (L.) Freshford, May.

„ *marginata* (Rossi) Freshford, June.

„ *fulva* (Mg.) Cranham, Gloucestershire.

„ *bipunctata* (Mg.) V.R.P.

SCENOPINIDÆ—Small, flat-bodied black flies, with peculiar wing venation, often seen on windows ; they have been bred from larvæ found in horsehair.

Scenopinus fenestralis (L.) Bristol, S.M., &c.

CYRTIDÆ—Very curious flies of medium size, with small heads and globular bodies, and having no mouths, the buccal cavity being covered with a membrane. The wings are comparatively small. The larvæ are parasitic on spiders (*Tegenaria*), and the flies have a certain resemblance to the spiders.

Oncodes pallipes (Latrl.) This fly seems extremely rare, I have only met with one specimen, a male, resting on a sprig of Rock Rose on Leigh Down, in August. Verrall reports it from Wells.

Acrocera globulus (Pz.) V.R.P. and Shepton Montagu (Verrall).

EMPIDÆ—Medium and small flies, with long bodies and legs, mostly hairy. Distinguished by the absence of the axillary lobe of the wing. They are all very rapacious.

Hybos grossipes (L.) S.M., September, and V.R.P.

Cyrtoma spuria (Fln.) Freshford, October.

„ *melæna* (Hal.) S.M., May.

Rhamphomyia sulcata (Fln.) Bristol, also Freshford, May.

„ *fuscipennis* (Zett.) Bleadon, August.

„ *filata* (Zett.) S.M., May.

Empis tessellata (F.) Very common everywhere.

„ *livida* (L.) Very common everywhere. I have noticed the singular habit of the male giving a prey to the female before coupling (see H. Hamm, Ent. Month. Mag., 1907).

„ *chioptera* (Fln.) S.M., May.

„ *pennipes* (L.) Bitton, Cheddar, and Freshford, June; also V.R.P.

„ *nigritarsis* (Mg.) S.M., May.

„ *decora* (Mg.) Cheddar, July.

„ *brunnipennis* (Mg.) Cheddar, July.

„ *vernalis* (Mg.) Cheddar, July.

„ *lutea* (Mg.) Gloster, July, and C.J. W.

„ *stercorea* (L.) V.R.P.

„ *punctatu* (Mg.) Freshford, May, and Redland, June.

„ *trigramma* (Mg.) S.M., May, and V.R.P.

Pachymeria femorata (F.) Ashton and Freshford, May.

Hilara niveipennis (Zett.) S.M., June.

„ *nigrina* (Fln.) Bristol, June.

„ *maura* (F.) Common throughout the district.

„ *pilosa* (Zett.) S.M., July.

„ *fuscipes* (F.) V.R.P.

In *Hilara* the fore metatarsus of the male is generally expanded into a disk. Said to envelop their prey in silken threads (M. Howlett, Entomol. Month. Mag., Oct., 1907).

Trichina flavipes (Mg.) Freshford, October.

Microphorus anomalus (Mg.) Leigh Woods, June.

Ædalea flavipes (Zett.) Cheddar, July.

Ocydromia glabricula (Mg.) S.M., May to September.

Tachypeza nubila (Mg.) S.M., June.

Tachista annulimana (Mg.) V.R.P.

„ *arrogans* (L.) S.M., June. This species closely resembles an Hemipteron, both in appearance and in habit of dodging to the under side of the leaf when pursued.

- Tachydromia maculipes* (Mg.) S.M., May.
 „ *articulata* (Mg.) Bristol, June.
 „ *annulata* (Fln.) Bristol, June.
 „ *minuta* (Mg.) Bristol, June.
 „ *ciliaris* (Fln.) Bristol, June.

DOLICHOPIDÆ—Medium sized, bright green, and very spiny flies, generally found by the waterside. Some have the metatarsi 'feathered,' which enables them to run freely on the water. For tables of the Dolichopidæ, which are extremely numerous, see Verrall, Entomolog. Month. Mag., 1904.

- Psilopus platypterus* (F.) S.M., July, and V.R.P.
 „ *wiedmanii* (Fln.) S.M., July.

- Dolichopus campestris* (Mg.) S.M., July.
 „ *confusus* (Zett.) S.M., August. Male with dilated fore-tarsi.
 „ *discifer* (Stan.) S.M., July. The dilated joint of the male has a white spot.
 „ *griseipennis* (Stan.) Keynsham and Redland, also V.R.P.
 „ *trivialis* (Hal.) S.M., June and V.R.P.
 „ *arbastorum* (Stan.) S.M., June.
 „ *plumipes* (Scop.) Batheaston (Blathwayt).
 „ *ungulatus* (L.) = *cæneus* (Deg.) Freshford, common, and V.R.P.

Pæcilobothrus nobilitatus (L.) S.M., July, fairly common.

Chrysotus læsus (W.) S.M. and Freshford, June.

„ *gramineus* (Flu.) S.M., fairly common in June.

Argyra diaphana (F.) Upton Cheney, June, and V.R.P.

Medeterus jaculus (Mg.) V.R.P.

Liancalus virens (Scop.) V.R.P., running about in wet spots.

LONCHOPTERIDÆ—Small, pale flies with straight wing veins, which are slightly different in male and female. Sometimes common in spring. Larvæ said to feed on the mycelium of fungi. Five out of the six British species occur in the district.

- Lonchoptera lutea* (Pauz.) Keynsham, March.
 „ *trilineata* (Zett.) Leigh Woods, June.
 „ *flavicauda* (Mg.) S.M., March.
 „ *lacustris* (Mg.) S.M., March.
 „ *tristis* (Mg.) S.M., March.

SECTION III.—PROBOSCIDÆ.

PLATYPEZIDÆ—Larvæ occur in fungi. Of the six species only one is recorded from the district.

Callimigia leptiformis (Fall.) Leigh Woods, Dale.

PIPUNCULIDÆ—Small, dark flies, with enormous eyes ; they are not usually common. They fly among short herbage, and the larvæ are parasitic on Homoptera.

Chalarus spurius (Fln.) S.M. and Bristol, in May.

Verrallia pilosa (Zett.) V.R.P.

„ *vilosa* (Ross.) Hanham, June.

„ *aucta* (Fln.) University garden, Bristol, August.

Pipunculus campestris (Ltr.) S.M., September, and V.R.P.

„ *geniculatus* (Mg.) S.M., September, and V.R.P.

SYRPHIDÆ—A large family of medium to large flies, with bright yellow and black markings. Many are fine hoverers. Many of the larvæ feed on Aphids.

Cnemodon vitripennis (Mg.) Freshford, April ; Redland, June.

Melangyna quadrimaculata (Verr.) Rare. Freshford, June. V.R.P.

Paragus tibialis (Fal.) Nailsea. University garden, Bristol, July. The larvæ are said to feed on root-Aphids ; but the flies are generally found associating with *Halicti*, which they closely resemble.

Pipizella virens (F.) Freshford and Redland in May.

„ *maculipennis* (Mg.) Redland, June, and V.R.P.

Pipiza noctiluca (L.) Nailsea and Freshford in May. Larvæ feed on the apple-root Aphis (*Shizoneura*). See Board of Agriculture Leaflet 34.

Orthoneura nobilis (Fal.) Taunton, June.

The following five species are beautiful metallic green flies :—

Liogaster metallina (F.) Fairly common at S.M. in June.

Chrysogaster splendens (Mg.) Taunton, June, and C.J.W.

„ *hirtella* (Lw.) Freshford and Bitton, April.

„ *macquarti* (Lw.) V.R.P.

„ *solstitialis* (Fln.) S.M., June, and V.R.P.

Chilosia. Medium to large mostly black flies, sometimes densely pubescent. Eye margins raised. Larvæ in fungi, &c.

Chilosia maculata (Fln.) Freshford, May.

„ *longula* (Zett.) Bristol, July.

„ *scutellata* (Fln.) Freshford, May ; Cheddar, September, and V.R.P.

„ *soror* (Zett.) S.M., April.

„ *pulchripes* (Lw.) S.M., August.

„ *variabilis* (Pz.) Freshford, May.

„ *honesta* (Rnd.) V.R.P.

„ *intonsa* (Lw.) Freshford, June.

„ *illustrata* (Har.) S.M. and Cheddar, August.

„ *chrysocoma* (Mg.) V.R.P.

„ *impressa* (Lw.) Leigh Woods, August ; Freshford, May.

„ *albitarsis* (Mg.) Freshford, July, and V.R.P.

„ *fraterna* (Mg.) Bitton, August.

„ *mutabilis* (Fln.) Freshford, May.

„ *vernalis* (Fln.) Bristol, September.

Chilosia cyanocephala (Lw.) Batheaston (Blathwayt).

„ *albipila* (Mg.) V.R.P.

Platychirus. Rather small, shining hoverers, with yellow spots on abdomen. Male with broad front tarsi. I have bred them from *Aphis*-feeding larvæ.

Platychirus manicatus (Mg.) S.M. and Bitton, May to September.

„ *tarsalis* (Schum.) Painswick (Wainwright), first record.

„ *discimanus* (Lw.) V.R.P.

„ *peltatus* (Mg.) Bitton, June.

„ *scutatus* (Mg.) S.M. and Redland, common in June.

„ *albimanus* (F.) Common throughout the district.

„ *scambus* (Staeg.) V.R.P.

„ *fulviventris* (Mcq.) V.R.P.

„ *angustatus* (Zett.) Minehead (Blathwayt) and V.R.P.

Pyrophæna granditarsa (Forst.) Rare. S.M., August; also V.R.P.

Seen on flowers of *Helosciadium* in marshy spot.

Melanostoma ambiguum (Fln.) Clifton Down, May.

„ *melinum* (L.) Common throughout the district.

„ *scalare* (F.) Common throughout the district.

Leucozona leucorum (L.) S.M., May; sometimes common. A beautiful fly, with base of abdomen white.

Ischrozyrphus glaucis (L.) Rare. Cheddar, August. The pale blue spots on the abdomen at once distinguish it.

Didea fasciata (Mcq.) Minehead (Blathwayt).

Catabomba pyrastris (L.) S.M. and Cheddar, common in July.

„ *selenitica* (Mg.) Stroud (Wainwright).

Syrphus. Medium sized beautiful hoverers; black and yellow.

Larvæ are aphid-eaters and real friends to the gardener.

Syrphus albostrigatus (Fln.) S.M. and Bristol, August; also V.R.P.

„ *tricinctus* (Fln.) V.R.P.

„ *venustus* (Mg.) Freshford, May, and V.R.P.

„ *lunulatus* (Mg.) Freshford and Cheddar, September, V.R.P.

„ *lasiophthalmus* (Zett.) Freshford and Leigh Woods, April.

„ *annulatus* (Zett.) Minehead (Blathwayt), Stroud (Wainwright).

„ *annulipes* (Zett.) Stroud (Wainwright), 1894, first record in Great Britain.

„ *grossularia* (Mg.) Batheaston (Blathwayt) and V.R.P.

„ *ribesii* (L.) Common everywhere.

„ *vitripennis* (Mg.) S.M. and Bristol, not rare in August.

„ *latifasciatus* (Mcq.) S.M. and Leigh Woods, August.

„ *nitidicollis* (Mg.) Leigh Woods, May to August.

„ *nitens* (Zett.) V.R.P.

„ *arcuatus* (Fln.) Painswick (H.J.C.)

„ *corollæ* (F.)

„ *luniger* (Mg.)

„ *bifasciatus* (F.)

„ *balteatus* (Deg.)

} Common everywhere.

- Syrphus cinctellus* (Zett.) Cheddar, sometimes common in August.
 „ *cinctus* (Fln.) Stroud (Wainwright).
 „ *auricollis* (Mg.) S.M. and Freshford, August, and V.R.P.
 „ *triangulifer* (Zett.) Stroud (Bradley).
 „ *punctulatus* (Verr.) Stroud (Wainwright).
 „ *umbellatarum* (F.) S.M. and Cheddar, September, and C.J.W., rare.
 „ *compositarum* (Verr.) Cheddar, August, rare.
 „ *labiatarum* (Verr.) Batheaston (Blathwayt). I have taken it in North Devon.
- Sphærophoria scripta* (L.) Common everywhere.
 „ *menthrasti* (L.) S.M., sometimes common.
 „ *flavicauda* (Zett.) Bristol, August, rare.
- Xanthogramma ornatum* (Mg.) S.M., sometimes common.
 „ *citrofasciatum* (Deg.) Very rare, Redland, on poppies, and V.R.P.
- Baccha obscuripennis* (Mg.) S.M., June.
 „ *elongata* (F.) Leigh Woods and Purdown.
- Sphegina clunipes* (Fln.) Rare, S.M., June, and V.R.P.
- Ascia podagrica* (F.) Common everywhere.
 „ *dispar* (Mg.) Rare, Redland, May.
- Brachyopa bicolor* (Fln.) Very rare, Bitton in May, and V.R.P.
- Rhingia rostrata* (L.) Very common everywhere.
- Volucella*. Large and beautiful flies resembling humble-bees. *V. inanis* resembles a wasp, in whose nests the larvæ live. The males are fine hoverers.
- Volucella bombylans* (L.) Fairly common in district. Resembles *Bombus lapidarius*.
 „ var. *plumata*. Fairly common, resembles *Bombus terrestris*.
 „ *inflata* (F.) S.M., June, very rare; also V.R.P.
 „ *inanis* (L.) Somersetshire in considerable numbers (Verrall).
 „ *pellucens* (L.) S.M., Cheddar, Bristol. Sometimes common.
- Eristalis*. ‘Drone Flies,’ bee-like and fine hoverers. Larvæ are ‘rat-tailed,’ and live in mud and water.
- Eristalis intricarius* (L.) Stapleton, July, rare.
 „ „ var-*furvus*, S.M., July, rare.
 „ *tenax* (L.) Very common everywhere.
 „ *sepulchralis* (L.) Very rare, Horfield, and S.M., August, and V.R.P.
 „ *arbustorum* (L.) Common everywhere. Several varieties occur, the commonest variety of the male being one that has white edges to the abdominal segments, and no yellow spots.
 „ *pertinax* (Scop.) Common everywhere, one variety has clear wings, another clouded wings.
 „ *nemorum* (L.) Rare, Cheddar, July, and V.R.P. Recognizable by the dark front tarsi.

Eristalis rupium (F.) V.R.P.

„ *horticola* (Deg.) Cheddar, Nailsea, and V.R.P.

Myiatropa florea (L.) Common, Cheddar, Bristol. Generally a very variable insect.

Helophilus trivittatus (F.) Cheddar (Curtis).

„ *pendulus* (L.) Occurs everywhere by the water-side.

„ *versicolor* (F.) Rare, Bitton, July, and V.R.P.

„ *lunulatus* (Mg.) Shapwick (C. W. Dale, Entomol. Month. Mag., vol. XXVIII., 1892)

„ *transfugus* (L.) Rare, Bitton, June.

These five species resemble *Eristalis*, but can always be recognized by the longitudinal stripes on the thorax. They are fine hoverers.

Merodon equestris (F.) A local species, Redland, Frampton Cotterell.

Very common at Wotton-under-Edge in 1903, V.R.P. A very variable fly, resembling a small humble-bee. I have bred it from larvæ in *Narcissus* bulbs.

Criorrhina ranunculi (Pz.) Near Bristol (Verrall), and V.R.P.

„ *berberina* (F.) Rare, S.M., June, on Bramble blossoms.

„ *oxyacanthæ* (Mg.) Minehead (Blathwayt), and V.R.P.

„ *floccosa* (Mg.) Rare, S.M., May, Stroud (Wainwright).

Xylota segrisi (L.) Common. Males sometimes swarm round Leigh Woods pond.

„ *lenta* (Mg.) Minehead (Blathwayt), and V.R.P.

„ *sylvarum* (L.) Freshford and Leigh Woods, June and July.

Syritta pipiens (St. F.) Common everywhere. Its early history is not known.

Eumerus ornatus (Mg.) Rare, Freshford, July.

„ *strigatus* (Fln.) Rare, Leigh Woods, July.

The larvæ of *Eumerus* are said to attack onion-bulbs, just as *Merodon* attacks *Narcissus* bulbs. The perfect insects have a strong resemblance to bees of the genus *Halictus*.

Chrysoclamys cuprea (Rond.) Rare, Nailsea, Freshford, Redland in July, and V.R.V.

Arctophila musitans (F.) Batheaston (Blathwayt), and C.J.W.

Sericomyia borealis (Fln.) V.R.P. A large black fly, with yellow bands, and a most beautiful insect, called the 'Singing fly' from a sharp hum it makes when at rest. I have taken it in numbers in North Devon, and it should occur on the Somerset Peat-moors, as the larvæ lives in Peat-bogs.

Chrysotoxum cautum (Har.) Rare, Sea Mills, June.

„ *arcuatum* (L.) Rare, Cheddar, in August.

„ *festivum* (L.) Rare, Freshford, July.

„ *bicinctum* (L.) S.M., Freshford, Bristol, sometimes common

Microdon mutabilis (L.) Langport Dale. A handsome insect that resembles a hive bee. The larvæ are slug-like, and were at first described as mollusca. The larvæ occur in ants' nests.

CONOPIDÆ—Medium sized wasp-like flies, black and yellow. The larvæ are parasitic in the bodies of humble-bees.

Conops quadrifasciatus (Deg.) S.M. and Cheddar in August, and V.R.P.

Oncomyia atra (F.) Painswick, C.J.W.

„ *pusilla* (Mg.) Very rare, S.M., August, Stroud (Wainwright).

Sicus ferrugineus (L.) Cheddar and Stapleton, August.

Myopa buccata (L.) V.R.P.

„ *testacea* (L.) Batheaston (Blathwayt).

„ *polystigma* (Rnd.) Painswick, C.J.W.

ÆSTRIDÆ—‘Bot Flies,’ larvæ parasitic in cattle, horses, and sheep, &c.

Gastrophilus equi (F.) The fly seems scarce, Wellington (Blathwayt) and C.J.W. The larvæ seems common in horses everywhere.

Æstrus ovis (L.) The fly at Painswick, C.J.W. The larvæ occurs in the nostrils of sheep.

Hypoderma bovis (Dig.) Very rare, Bitton, July, and C.J.W. I only caught the fly *twice*, once at Bitton and once in North Devon. The larvæ is too common in tumours on the backs of cattle. For the extraordinary life-history, see Journal Royal Micros. Soc., 1908; also Miss Ormerod, “Flies Injurious to Stock”; also (for *H. lineatum*) Board of Agriculture Leaflet 21.

TACHINIDÆ—A large family of spiny and hairy flies, mostly black or grey. In the larval stage they are parasitic in the bodies of other insects, oftenest in lepidopterous larvæ. The life-histories of many are unknown.

Heteronychia chaetoneura (Br.) Chalford and Selsby, Glos. (Wainwright).

Engyops micronyx (Br.) Cranham (Wainwright).

Melanomyia nana (Mg.) Chalford (Wainwright).

Thelairia leucozonæ (Pz.) Redland, frequent. Have bred it from a noctuid pupa.

Nyctia halterata (Pz.) V.R.P.

Meigenia bisignata (Mg.) Cranham, Glos. (Wainwright).

„ *floralis* (Mg.) Chalford and Selsley (Wainwright).

Ceromasia stabulans (Mg.) V.R.P.

„ *senilis* (Mg.) V.R.P.

Gymnocheta viridis (Dw.) Brilliant metallic green, Stroud (Wainwright). I have found it common in North Devon.

Blepharidea vulgaris (Fln.) Selsley (Wainwright), bred from larvæ of the gooseberry-moth, *A. grossulariata*.

Aporomyia dubia (Fln.) Selsley (Wainwright).

Bothria cæsifrons (Mcq.) Selsley (Wainwright).

- Macquartia tenebricosa* (Mg.) } Selsley (Wainwright).
 „ *chalconotus* () }
- Rhychista prolixa* (Mg.) Selsley (Wainwright).
Ptilops chalybeata (Mg.) Selsley (Wainwright).
Hyalomyia pusilla (Mg.) Selsley (Bradley).
Oliveria lateralis (F.) Cheddar, S.M., Bristol, common. A spiny black fly, with hairy eyes, and the upper half of abdomen orange red.
Micropalpus vulpinus (Fln.) Cheddar, September, and V.R.P.
Erigone radicum (F.) Redland, August.
 „ *rudis* (Fln.) V.R.P.
Echinomyia grossa (L.) Dundry.
 „ *fera* (L.) Common on Thistle blooms, Leigh Woods.
 „ *ferox* (L.) Wellington (Blathwayt).
Servillea ursina (Mg.) Leigh Woods, June, rare. A large fly, covered with a dense coat of long silky hairs, as well as spines.
Plagia ruralis (Fln.) } Selsley (Wainwright).
 „ *trepida* (Mg.) }
- Siphona geniculata* (Deg.) S.M. and Bristol, common in May.
 „ *cristata* (F.) Bristol, July.
- These two species are easily distinguished by their 'elbowed' proboscis. The front part shutting back like the blade of a penknife.
- Alophora hemiptera* (F.) Chalfont (Wainwright). I have taken this rare and curious insect, which resembles an Hemipteron on account of its broad flattened abdomen, in North Devon.
- Trixa æstroidea* (Dsv.) Selsley (Wainwright).
Phyto melanocephala (Mg.) Selsley (Wainwright).
Melanophora roralis (L.) Redland and Taunton in June.
 „ *atra* (Mcq.) Fairly common in the University garden, Bristol; also at Bitton, and C.J.W.
- These two are small, intensely black and bristly flies.
- Brachycoma erratica* (Mg.) Painswick, C.J.W., described as new to Britain in E.M.M., 1893.

SARCOPHAGINÆ—A sub-family of the Tachinidæ. They include the common chequered grey and black 'flesh-flies,' they are all very bristly, and produce living larvæ (ovo-viviparous).

- Cynomia mortuorum* (L.) Gloucester (Merrin).
Onesia sepulchralis (L.) Nailsea and Freshford, May to August.
 „ *cognata* (Mg.) Freshford and Leigh Woods, April; also V.R.P.
Sarcophaga carnaria (L.) Very common everywhere.
 „ *albiceps* (Mg.) Cheddar, July.
 „ *atropos* (Mg.) Keynsham and Cheddar, July; also V.R.P.

- Sarcophaga agricola* (Mg.) Redland and Freshford, May.
 „ *nigriventris* (Mg.) Bitton, July. C.J.W. has bred it at Painswick from decayed snails.
 „ *hæmorrhœa* (Mg.) Redland and S.M., June.
 „ *hæmorrhœa* var *setipennis* (Rnd.) R.V.P.
 „ *infantula* (Rnd.) Stonehouse, June.
 „ *dissimilis* (Mg.) V.R.P.
 „ *hæmatocles* (Mg.) V.R.P.
 „ *hæmorrhoidalis* (Mg.) Horfield, July, rare.
 „ *nurus* (Rnd.) Redland, common in June.

Metopia leucocephala (Rossi.) Cranham (Wainwright).
 „ *campestris* (Fln.) Leigh Woods, August, rare.

The larvæ of these two species are parasitic on larvæ of sand-wasps; the flies are distinguished by their brilliant white faces.

DEXINÆ—A sub-family of the Tachinidæ, said to be parasitic in the larval stage on beetles and snails.

- Dexia vacua* (Fln.) Cheddar, July and August, and C.J.W.
 „ *rustica* (F.) V.R.P.
Dexiosoma caninum (F.) V.R.P.

MUSCIDÆ—True flies, such as blue-bottles and house flies.

Stomoxys calcitrans (L.) ‘The sting fly,’ common about houses in autumn, rather like a house fly, but is greyer, and the proboscis is evident, pointing forwards under the head. It is a sharp biter.

Pollenia vespillo (F.) V.R.P.

- „ *rudis* (F.) Common everywhere; hibernates in holes in tree-trunks or in houses.

Myiospila mediatubunda (F.) Taunton and Bitton, also V.R.P.

Graphomyia maculata (Scop.) Sometimes common. A handsome little fly.

Musca domestica (L.) ‘The housefly,’ very common everywhere, does not generally appear in-doors before June.

- „ *corvina* (F.) Very abundant in spring. The larvæ sometimes hatches out, and remains for a while within the parent.

Cyrtoneura stabulans (Fln.) Very common. Hibernates in-doors in swarms.

Morellia simplex (Lw.) Common. I found a number of the larvæ living on the dead bees in an old hive.

- „ *hortorum* (Fln.) Very common.
 „ *curvipes* (Mcq.) Not common. S.M., October.

Mesembrina meridiana (L.) Common. A handsome black fly, with the base of the wings yellow. Viviparous.

Pyrellia cadaverina (L.) V.R.P.

- „ *serena* (Mg.) V.R.P.
 „ *lasiophthalma* (Mcq.) Batheaston (Blathwayt).
 „ *eripthalma* (Mcq.) S.M., August.

Proticalliphora grœnlandica (Ztt.) Very local. Found once in swarms in the garden of Bristol University in June, also Cheddar.

Calliphora. 'The blue-bottles.'

Calliphora erythrocephala (Mg.) Very common everywhere. Cheeks red, with black hairs.

„ *vomitaria* (L.) Very common. Cheeks black, with red hairs. This latter is the commoner out-of-doors.

Euphoria cornicina (F.) Freshford, S.M., &c. Common.

Lucillia. 'The green-bottles.'

Lucillia regina (Mg.) Bristol, April.

„ *cæsar* (L.) Common everywhere.

„ *ruficeps* (Mg.) Bristol, August.

„ *illustris* (Mg.) S.M., June.

„ *sylvarum* (Mg.) V.R.P.

„ *sericata* (Mg.) Common. Larvæ are known as 'sheep maggot,' and cause much damage, the eggs are laid in the wool.

ANTHOMYIDÆ—A very large group of mostly grey flies, but with the long veins running straight to the tip of the wing.

Poliates lardaria (F.) Sometimes very common.

„ *albolineata* (Fln.) V.R.P.

Hyetodesia incana (W.)

„ *leucorum* (Fln.)

„ *semicinerea* (W.) } V.R.P.

„ *læta* (Fln.)

„ *erratica* (Fln.) Freshford, July ; V.R.P. and S.M. in January.

„ *signata* (Mg.) V.R.P.

„ *errans* (Mg.) V.P.O.

„ *scutellaris* (Fln.) Bitton, June.

„ *abdominalis* (Zett.) V.R.P.

„ *pallida* (F.) Bitton, August.

Allæostylus simplex (W.) Freshford, May.

Mydæa pagana (F.) Bristol and Freshford.

„ *urbana* (Mg.) V.R.P.

„ *impuncta* (Fln.) Freshford, June.

Spilogaster duplicata (Mg.) V.R.P.

„ *communis* (Dsv.) Generally distributed through the district.

„ *uliginosa* (Fln.) Bristol, June.

„ *quadrum* (Fln.) V.R.P.

„ *pertusa* (Mg.) Nailsea, July.

Spilogaster feeds sometimes on pollen.

Hydrotea ciliata (F.) V.R.P. and Batheaston (Blathwayt).

„ *dentipes* (F.) Common.

„ *irritans* (F.) Very common.

- Ophyra leucostoma* (W.) S.M., common. Larvæ in decaying wood.
 „ *anthrax* (Mg.) V.R.P.
Drymia hamata (Fln.) V.R.P.
Trichopticus pulcher (Mde.) S.M., April.
Hydrophoria conica (W.) Common.
Hylemia variata (Fln.) V.R.P.
 „ *strigosa* (F.) Common, viviparous, larvæ in dung.
Eustalomyia festiva (Zett) Painswick, C.J.W. Parasitic on *Pemphredon*.
Anthomyia pluvialis (L.) Frequent, but local.
 „ *radicum* (L.) Very common, as larvæ, in radishes.
Chortophila albescens (Zett.) } Swinford. Parasitic on *Halictus*.
 „ *trapezina* (Zett.) }
 „ *sepia* (Mg.) V.R.P.
Phorbia floccosa (Mcq.) V.R.P.
 „ *cilicrura* (Rnd.) C.J.W.
 „ *cepetorum* (Mde.) Bristol. Larvæ in onions.
Pegomyia silacea (Mg.) V.R.P.
Homalomyia fuscula (Fln.) V.R.P.
 „ *canicularis* (L.) Very common everywhere.
 „ *incisurata* (Zett.) V.R.P.
 „ *coracina* (Lw.) V.R.P.
Caricea tigrina (F.) S.M. and V.R.P.; is fiercely predaceous on other flies.
 „ *humilis* (Mg.) V.R.P.
Lispe tentaculata (Deg.) S.M., frequents puddles, running on the water and preying upon larvæ of *Chironomus*, &c.

CORDYLURIDÆ—Medium sized, densely hairy flies, mostly yellow or grey; they are very predaceous.

- Cordylura pubera* (F.) V.R.P.
Paralleloma albipes (Fln.) Bully, Glos., C.J.W.
Amaurosoma flavipes (Fln.) S.M. Bred from larvæ in dock leaves.
Norellia spinimana (Fln.) S.M., August, and V.R.P.
Scatophaga. The dung flies; they are covered with a pile of yellow hair, and are very voracious, being often seen sucking flies much bigger than themselves.
Scatophaga ordinata (Beck.) S.M., May.
 „ *maculipes* (Zett.) S.M., May.
 „ *suilla* (F.) S.M., October.
 „ *inquinata* (Mg.) V.R.P.
 „ *analís* (Mg.) V.R.P.
 „ *lutaria* (F.) Common.
 „ *merdaria* (F.) Common.
 „ *stercoraria* (L.) Very common everywhere.
 „ *squalida* (Mg.) V.R.P.

Orygma luctuosum (Mg.) Clevedon and Weston. Common.

HELOMYZIDÆ—

<i>Helomyza rufa</i> (Fln.)	} V. R. P.
„ <i>variegata</i> (Lw.)	
„ <i>affinis</i> (Mg.)	
„ <i>pallida</i> (Fln.)	
„ <i>ustulata</i> (Mg.)	

Blepharoptera serrata (L.) S.M.

„ *flavicornis* (Lw.) Nailsea, June.

Heteromyza commixta (Coll.) S.M., March.

Heteroneura albimana (Mg.) Freshford, May. Bred from pupæ found in burrows of *Crabro*.

Phæomyia fuscipennis (Mg.) S.M., May.

SCIOMYZIDÆ—

Dryomyza flaveola (F.) S.M., May and June.

Neottiophilum præustum (Mg.) V.R.P.

Neuroctena anilis (Fln.) S.M., June ; has been found in *Cossus* burrows in decayed trees.

Sciomyza albocostata (Fln.) V.R.P.

„ *cinerella* (Fln.) S.M., September, Selsley (Wainwright).

Tetanocera elata (F.) Selsley (Wainwright).

„ *sylvatica* (Mg.) V.R.P.

„ *ferruginea* (Mg.) Minehead (Blathwayt).

„ *coryleti* (Scop.) S.M., May.

„ *punctulata* (Scop.) S.M. and Redland.

Limnia unguicornis (Scop.) S.M., July ; Selsley (Wainwright).

„ *rufifrons* (F.) S.M., July.

„ *obliterata* (F.) Freshford, July, and C.J.W.

Elgiva albiseta (Scop.) Freshford, July.

„ *culcularia* (L.) Minehead (Blathwayt)

Sepedon sphegeus (F.) V.R.P.

„ *spinipes* (Scop.) V.R.P.

„ *heffneri* (Fal.) Minehead (Blathwayt).

PSILIDÆ—

Psila fimetaria (L.) Freshford and Redland, also V.R.P.

„ *atra* (Mg.) S.M., May.

„ *rosæ* (F.) S.M., May.

Chyliza leptogaster (Pz.) Selsley (Wainwright).

Loxocera albiseta (Sch.) Bristol, May, and V.R.P.

MICROPEZIDÆ—

Micropeza corrigiolata (L.) Redland, July, and V.R.P.

Calobata petronella (L.) V.R.P.

Loxodesma lacustris (Mg.) V.R.P.

ORTALIDÆ—Small flies, with spotted or barred wings, many of them very beautiful. Most of the larvæ seem to be vegetable feeders.

Darycera graminum (F.) Withycombe (Slater). Horfield in June.

Platysoma seminationis (F.) Nailsea and Freshford, June.

Seoptera vibrans (L.) Nailsea and Bristol.

Ptilonota guttata (Mg.) Freshford, May.

Pteropæctria frondescantiæ (L.) Bristol, July.

„ *nigrina* (Mg.) Cheddar, August.

„ *afflicta* (Mg.) S.M., August.

Ceroxys pictus (Mg.) St. Vincent's Rocks, Clifton (Curtis), and V.R.P.

„ *crassiformis* (F.) V.R.P.

Ulidia eryophthalma (Mg.) Redland, May, and V.R.P.

TRYPETIDÆ—Pretty little yellow and black flies, with spotted wings.

Rhagoletis cerasi (L.) Very rare. One specimen University garden, Bristol, July.

Acidia lychnidis (F.) V.R.P.

„ *heraclii* (L.) Bristol; S.M. in May, frequent.

Spilographa zoë (Mg.) S.M. Common.

Trypeta onotrophes (Liv.) S.M., August, and V.R.P.

„ *cornuta* (F.) Bristol, and V.R.P.

„ *lappæ* (Cedj.) V.R.P.

Urophora solstitialis (L.) Minehead (Blathwayt).

„ *cardui* (L.) V.R.P.

„ *aprica* (Fln.) Minehead (Blathwayt), and V.R.P.

Sphenella marginata (Fln.) V.R.P.

Tephritis bardanæ (Sch.) Nailsea, June, and C.J.W.

„ *vespertina* (Lw.) Bristol, June, and V.R.P.

„ *leontodonis* (Deg.) V.R.P.

Urellia cometa (Lw.) V.R.P.

LONCHÆIDÆ—Small, shining dark blue or green flies.

Lonchea vaginellis (Fln.) Bristol, July, and V.R.P.

„ *chorea* (F.) V.R.P.

Palloptera ustulata (Fln.) S.M., August.

„ *umbellatarum* (F.) Nailsea, June, and V.R.P.

„ *saltuum* (L.) V.R.P.

„ *arcuata* (Fln.) V.R.P.

SAPROMYZIDÆ—

- Sapromyza lupulina* (F.) V.R.P.
 „ *decempunctata* (Fln.) S.M., July ; Horfield, June.
 „ *pallidiventrīs* (Fln.) V.R.P.
 „ *litura* (Curt.) Nailsea, August. Very rare.
 „ *rorida* (Fln.) V.R.P.
 „ *præusta* (Fln.) Nailsea, June, and V.R.P.
Lauxania cylindricornis (F.) V.R.P.
 „ *cænea* (Mg.) V.R.P.

OPOMYZIDÆ—

- Balioptera combinata* (L.) V.R.P.
Opomyza germinationis (L.) Bristol and Cheddar.

SEPSIDÆ—Little black flies, mostly with a spot at the tip of the wing.

- Sepsis punctum* (F.) V.R.P.
 „ *cynipsea* (L.) Common everywhere. I have seen thousands in a spot a few yards square, resting on foliage ; when disturbed they would rise in a cloud, and alight again in the same place.
Nemopoda cylindrica (F.) Redland, June, and V.R.P.
 „ *stercorea* (Dsv.) S.M. Very common.
Themira putris (L.) Redland, May.
 „ *leachii* (Mg.) S.M., August.
Saltella scutellaris (Fln.) Langport, Dale.
Piophilæ casei (L.) ‘The Cheese fly.’ Bristol, S.M., &c.

EPHYDRIDÆ—Small, mostly grey flies, generally found near water.

- Ilythea spilota* (Hal.) S.M. in winter. A tiny fly with the wings so thickly spotted as to appear almost black.
Tichomyza fusca (Mcq.) Keynsham, July.
Notiphila guttiventris (Stn.) Bristol and Bitton, June.
 „ *cinerea* (Fln.) Bitton, June.
Discocerina nigrina (Stn.) S.M., June.
Hydrellia griseola (Fln.) S.M., July.
 „ *hydrocotyles* (Hal.) S.M., March. The larva is said to live and pupate in fronds of duck-weed (*Lemna*).
Scatella sorbillans (Hal.) S.M., July.
 „ *noctula* (Mg.) S.M., July.

These two species are to be found running on the surface of a pond.

DROSOPHILIDÆ—

- Drosophila funebris* (F.) Redland, August.
 „ *confusa* (Stæg.) S.M., February.

CHLOROPIDÆ—Light green or yellow flies, some with clear black markings.

Meromyza pratorum (Mg.) V.R.P.

„ *saltatrix* (L.) Willsbridge, June. A pale green fly, with bright emerald green eyes in life.

Diplotoxa messoria (Fln.) V.R.P.

Chlorops tæniopus (Mg.) V.R.P.

„ *rufa* (Mg.) S.M., October.

„ *notata* (Mg.) V.R.P.

„ *rufina* (Zett.) Redland, June.

Chloropisca ornata (Mg.) V.R.P.

„ *glabra* (Mg.) Bristol, April.

AGROMYZIDÆ—

Agromyza ornata (Mg.) Redland, July.

PHTOMYZIDÆ—

Phytomyza terminalis (Mcq.) Redland, July.

Chromatomyia obscurella (Fln.) S.M., January.

„ *ilicis* (Curt.) Bristol. Larvæ mining holly leaves.

„ *affinis* (Mg.) Bristol, May.

Astia amæna (Mg.) S.M., May.

BORBORIDÆ—Small, black, and flat-looking flies, common on horsedung in spring.

Borborus geniculatus (Mcq.) Common everywhere.

„ *suillorum* (Hal.) S.M., May.

„ *niger* (Mg.) S.M., March.

„ *equinus* (Fln.) Common everywhere.

Sphærocera subsultans (F.) Very common.

„ *vaporarium* (Hal.) V.R.P.

Limosina sylvatica (Mg.) V.R.P.

„ *lugubris* (Hal.) } Bristol, February.

„ *armata* }

„ *limosa* (Fln.) }

„ *leucoptera* (Hal.) } S.M., March.

„ *vitripennis* (Zett.) }

PHORIDÆ—Very small, black, bristly flies, which run rapidly on windows, &c. They are a very difficult group, and include numerous species; for synopsis see Dr. Wood, E.M.M., 1908, &c.

Phora maculata (Mg.) S.M., March.

„ *rufipes* (Mg.) V.R.P.

„ *lutea* (Mg.) S.M. A number of larvæ came out of a dead dragon fly (*Æschna cyanea*) and pupated in the box which contained it. Dr. Wood very kindly identified the flies as *P. lutea* (Mg.)

Conicera atra (Mg.) Bristol, June. They sometimes dance in swarms in the air, like midges.

HIPPOBOSCIDÆ—Curious flat, louse-like flies, that live as external parasites on birds and mammals. They are 'pupiparous,' the larvæ passing its life within its parent and pupating in its body.

Ornithomyia aviculare (L.) Bristol, on Heron, Red Grouse, and Long-eared Owl; also V.R.P.

Stenopteryx hirundinidis (L.) S.M., on House Martin.

Oxypteryum pallidum (Leach) Bristol, on Swifts.

Melophagus ovinus (L.) Common on sheep. I have found them on a horse.

BRAULIDÆ—Curious wingless and crab-like insects found on hive-bees.

Braula cæca (Nitz.) Bristol, sometimes common. It is wingless and blind.

NYCTERIBIDÆ—Spider-like parasites of bats.

Nycteribia hermanni (Leach) On *Rhinolophus hipposideros*, found in Cheddar Caves by T. A. Coward, F.Z.S.

I should wish to acknowledge the kindly help, in naming some of the species, I have received from the late Mr. G. H. Verrall, F.E.S., and Mr. J. E. Collin, F.E.S.

Further Work on the Silurian Rocks of the Eastern Mendips.

By S. H. REYNOLDS, M.A., F.G.S.

IN the Silurian Inlier in the Eastern Mendips, which was first described in 1907,¹ three main lithological types were met with, viz. :—

1. Pyroxene-andesite forming an Eastern or Downhead mass, and a Western or Moon's Hill and Sunny Hill mass.

2. A peculiar coarse ashy conglomerate exposed in two areas, one lying between the two andesite masses, and a second at the western extremity of the inlier. The relations of this deposit to the other strata were not clear, but of the various possibilities the most probable seemed to be that it represented two necks or vents.

3. Tuffs fine and moderately coarse, the former containing a fauna of Silurian, probably Llandovery, date, were seen at Sunny Hill to dip below the andesite, and were exposed by trenching at several points along the south-eastern boundary of the inlier. A band of tuff was also found interbedded in the andesite at Sunny Hill.

In the latter part of 1907 fresh sections in fossiliferous Silurian rocks were exposed to the S.E. of the Moon's Hill quarry owing to the laying of a line of rails from the Downhead quarry; and at the Leicester meeting of the British Association in 1907, a committee was appointed to further investigate the Silurian rocks of the Bristol area and of the Mendips. Under the auspices of this committee a series of trenches was dug and some fossils collected, which were determined by Mr. F. R. Cooper Reed and assigned by him to the Llandovery. No tuffs were met with in the area to the S.E. of the Moon's Hill quarry, the prevalent rock being a somewhat sandy mudstone.

A tuff band was, however, found interbedded in the Moon's Hill andesite. No further information was obtained as regards the nature of the coarse ashy conglomerate. The report of this committee was published in the Dublin (1908) volume of the British Association Reports, pp. 286—289.

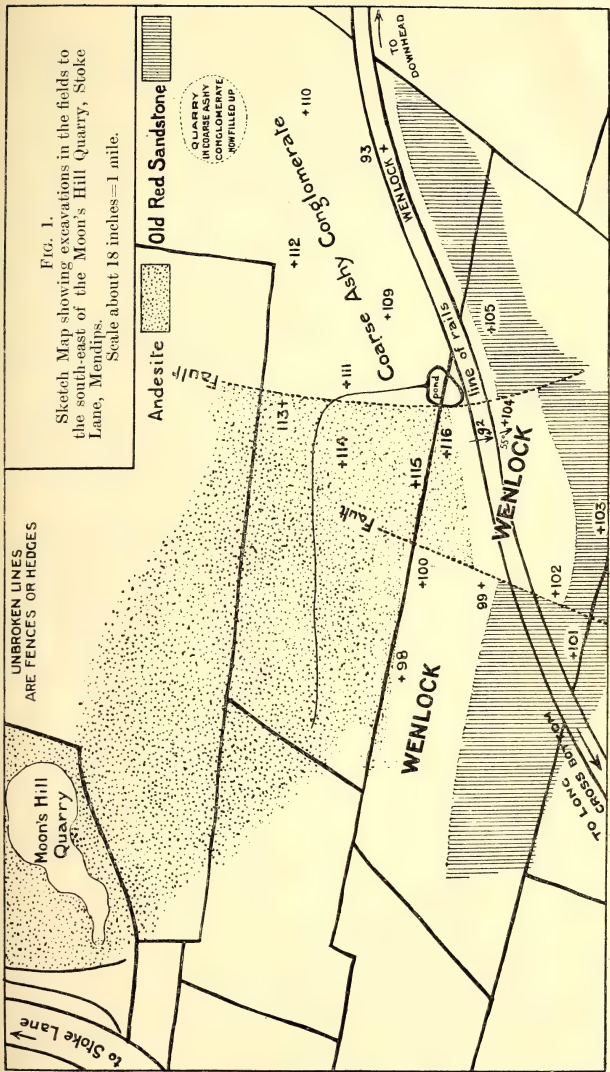
Further work² has since then been carried out, and points of interest have been ascertained in both the Moon's Hill and Downhead areas.

I.—THE MOON'S HILL AREA.

During 1911 sixteen trenches were dug in the area to the S.E. of Moon's Hill. The position of the trenches is shown in the

¹ Quart. Journ. Geol. Soc. Vol. LXIII. (1907), pp. 217-240.

² An account of this work was brought before the British Association at Portsmouth in 1911, and a short report appears in the volume for that meeting, p. 381.



map (p. 77), the accompanying number being in each case that with which the specimens were labelled. The following are the details relative to these trenches:—

98. At a depth of about four feet fine-grained micaceous yellow sandstone was met with.

99. Thin-bedded, greenish-yellow, slightly micaceous sandstone, with poorly preserved fossils, was entered at a depth of four feet.

100. The trench passed through some five feet of surface material containing many bits of yellow micaceous sandstone, but nothing was met with *in situ*.

101. This trench was carried to a depth of five feet in weathered Old Red Sandstone, but the underlying Silurian rocks were not reached.

102. Gritty mudstone with ill-preserved fossils was entered at a depth of four feet. Mr. Reed recognised *Beyrichia*, *Orthis*, *Meristella*, and *Plectambonites*, but none of the specimens were good enough to be specifically determined.

103. The same as at 101.

104. This trench soon entered fossiliferous sandy mudstone similar to that exposed in the rail-cutting at 92. The beds dipped at 55° S.S.E., affording confirmation of the somewhat doubtful dip obtainable in the rail-cutting at 92.

The following fossils, kindly identified by Mr. F. R. Cowper Reed, were obtained from this trench, and the assemblage is clearly of Wenlock rather than Llandovery character:—

* *Atrypa reticularis* Linn.
 * *Orthis pecten* Linn.
 * *Spirifer sulcatus* His.
 * *Pholidops implicata* Sow.
 * *Leptaena rhomboidalis* Wilck.
Atrypa imbricata Sow.
Orthis elegantula Dalm.
Chonetes striatella Dalm.
Plectambonites transversalis
 Wahl.
Spirifer elevatus Dalm.
Rhynchotrete cuneata Dalm.
Scenidium lewisi? Dav.
Strophonella euglypha? His.
Strophomena? sp.

Ptilodictya lanceolata Goldf.
Pterinea retroflexa Wahl.
Orthoceras sp.
Beyrichia sp.
Phacops (Dalmanites) caudatus
 Brunn.
Phacops (Phacopidella) sp.
Acidaspis quinquespinosus
 Fl. and Salt.
Encrinurus punctatus Brunn.
Proetus stokesi? Murch.
Cornulites serpularius Schloth.
Lindstræmia subduplicata?
 McCoy.
Alveolites? n.sp.

105. A hard grit of Old Red Sandstone type was soon entered at this point.

109. This trench was carried to a depth of 4½ feet, no rocks were struck *in situ*, but at the bottom tough clay, full of large pieces of tuff, was met with. Although no pebbles were found, it seems

probable that this deposit forms part of the coarse ashy conglomerate mass lying to the N.E.

110. This trench was carried to a depth of 5 feet, the last $2\frac{1}{2}$ feet being in coarse ashy conglomerate with the usual tuff matrix. The pebbles were mainly of andesite, but one of quartzite was met with.

111. At a depth of 18 inches fine tuff was entered. Here again, as at 109, pending further evidence, it seems more probable that this is a fine-grained patch in the coarse ashy conglomerate than that it indicates the presence of a tuff-band in the Wenlock beds.

112. This trench was carried to a depth of $5\frac{1}{2}$ feet. The upper 4 feet was exceedingly tough red clay. This passed into yellowish sandy clay, clearly disintegrated coarse ashy conglomerate, blocks of which were contained in it.

113. Normal Moon's Hill pyroxene-andesite was entered at a depth of 18 inches.

114. This trench was taken to a depth of $4\frac{1}{2}$ feet, when work was stopped by water getting in. The upper 3 feet was tough red clay with blocks of Old Red Sandstone, the lower $1\frac{1}{2}$ feet was full of bits of andesite, which were rather vesicular, an unusual character among the Eastern Mendip rocks. It is practically certain that andesite is the country rock here.

115. After penetrating 5 feet of tough red clay andesite was struck *in situ*.

116. Fresh pyroxene-andesite of Moon's Hill type was entered at a depth of about a foot. At this point we have andesite occurring within a very few yards of the fossiliferous Wenlock beds of the rail-cutting, and still nearer to similar beds exposed by trenching in 1907. The dip of the fossiliferous beds is such as to show that if no fault intervenes they clearly rest on the andesite. The finding of andesite at the spots 115 and 116 proves that it extends here considerably further to the south than was formerly supposed.

In the British Association Report, Dublin, 1908, p. 287, a list of fossils is given which were found in the fine greenish sandy shale or mudstone exposed at the spot 92 in a cutting about 600 yards N.E. of Long Cross Bottom. The following additions have been made to this list, many of the specimens having been collected by members of the Geologists' Association when visiting this exposure in June, 1909:—

Monticuliporoid

Orthis elegantula Dalm.

Atrypa reticularis Linn.

Orbiculoidea rugata Sow.

Scenidium lewisi Dav.

Meristina tumida Dalm.

Rhynchonella (*Camarotoechia*)
borealis Schloth.

Ptilodictya lanceolata Goldf.

Ptilodictya? scalpellum Lonsd.

Ctenodonta sp.

Pterinea retroflexa Wahl.

Beyrichia klædeni McCoy.

Beyrichia sp.

Phacops (*Dalmanites*) *caudatus*
Brünn. (common)

Phacops musheni Salt.

Proetus fletcheri Salt.

Encrinurus punctatus Brünn.

The information derived from these trenches is sufficient to fully establish the fact that to the south-east of Moon's Hill a thin development of sediments containing a Wenlock fauna occurs with a dip such that, if no fault intervenes, these rocks overlie the andesite of Moon's Hill. The Silurian rocks at the Sunny Hill quarry, a quarter of a mile to the west, are on the contrary older than the andesite, and the scanty fauna they contain is probably of Llandovery age.

The occurrence of Old Red Sandstone at the point 103 shows that the width of outcrop of the Wenlock is here only some 60 yards, and with a dip of 55° this would indicate a thickness of about 120 feet. On the other hand, the occurrence of Silurian sediments at the spots 98 and 100 is best explained by a fault, as is the sudden change in the character of the material met with in the shallow rail-cutting,—Old Red Sandstone debris, followed by the rock in place, being abundant to the west of a line joining the spots 100 and 102, while to the east of it Silurian rocks occur.

Although several trenches were dug with the intention of penetrating the junction between the Old Red Sandstone and the Silurian, this was not accomplished, and it is uncertain whether any Ludlow beds occur. No trace of a Ludlow fauna has been met with, and the nearness of the gritty mudstone with Wenlock fossils at the points 102 and 104 to the Old Red Sandstone at 103 is such that any Ludlow beds if present at all must be very thin. It is probable that the highest Silurians and the lowest Old Red Sandstone are both missing, and, as far as the scanty evidence available from dips goes, there is a considerable discordance between the Wenlock and Old Red Sandstone. The Wenlock rocks exposed in the trench at 104 were clearly seen to dip at 55° S.S.E., while the Old Red Sandstone in the rail-exposure seems to dip at about 40° S.S.W.

If one walks along the rails eastward from 92, a little pond will soon be noticed lying just north of the line. From this point eastwards the relations of the rocks are more difficult to understand. Old Red Sandstone was proved at the point 105, and unfossiliferous gritty beds clearly related to the neighbouring fossiliferous Silurians are seen by the rails at 93. It thus seems clear that the Silurian sediments and Old Red Sandstone to the east of the pond have the same mutual relationship as those to the west. But the trenches in the field to the north-east of the pond exposed not andesite but fine tuff or the peculiar coarse ashy conglomerate, the nature of which has been one of the most puzzling problems presented by this Silurian inlier. The coarse ashy conglomerate was formerly exposed in a considerable pit in the next field to the north (see Q.J.G.S., Vol. lxiii., 1907, p. 228, fig. 4), but this was filled up in 1908, and scarcely a trace of it remains. The relations of this deposit to the other rocks are difficult to ascertain. It seems most probable that the line of junction between it and the andesite to the west is faulted, and a fault has been tentatively inserted in the map, but further evidence is required to show the relation of the coarse ashy con-

glomerate to the Silurian rocks exposed by the rails at 93. Unfortunately, the farmer who has already had 17 trenches dug in his fields, objects to having any more made.

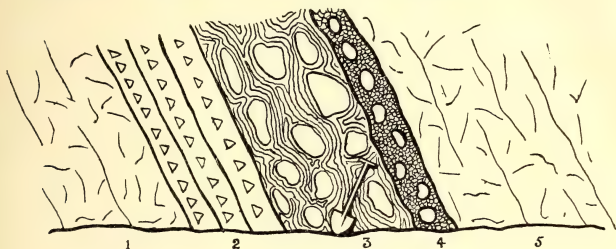


FIG. 2.

Section in the eastern wall of the Downhead Quarry, Mendips.

Length of section about 10 yards.

(The numbers correspond to those in the text, page 81).

2.—DOWNHEAD.

The Downhead quarry has been considerably enlarged during the last few years, and at the present time (1912) is being rapidly extended to the north, leaving an upstanding mass of rock in the middle of the quarry. This upstanding mass is of particular interest, as it is to a considerable extent composed of tuff interbedded with the andesite. The best section is seen in the cutting between the eastern wall of the quarry and this upstanding mass, and is as follows, at the top:—

- | | |
|--|-----------------|
| 5. Pyroxene-andesite, often much crushed, extending to the southern margin of the quarry. Thickness 100 feet or more. | |
| 4. A band of fine tuff showing marked spheroidal weathering. This band is better seen in the middle of the quarry, where the unweathered portions form prominent bomb-like masses. The weathered portion crumbles readily into little polygonal pieces | ft. ins.
1 6 |
| 3. A band consisting of rounded masses of andesite with slickensided surfaces embedded in crushed and weathered andesitic material, much of it reduced to the appearance of crushed red shale | 8 0 |
| 2. Fine-grained purple or reddish tuff dipping at about 60° S. or a little E. of S. | 7 0 |
| 1. Pyroxene-andesite considerably crushed and slickensided to end of quarry. Thickness not ascertained. | |

These bands are somewhat impersistent, thus while band 4 is (1912) finely exposed on the southern face of the upstanding mass

in the middle of the quarry, band 3 is not well seen, and no sign of band 2 was found. On the other hand, in the western part of the quarry, though the rocks are very much crushed, a tuff-band is recognisable, and band 3 is well-seen.

As far as is known at present the general succession of Silurian rocks in the Eastern Mendips is as follows :—

Wenlock	{	Mudstone often very fossiliferous, with subordinate bands of highly micaceous sandstone or grit exposed in the rail cuttings and by trenching in the fields to the S.E. of the Moon's Hill quarry.	
		Thickness about	120 ft.
		Pyroxene-andesite of Moon's Hill, Sunny Hill, and Downhead quarries. In each case some tuff is interbedded with the andesite. Thickness probably not less than	400 ft.
? Llandovery	{	Tuff coarse and fine exposed in Sunny Hill quarry and by trenching at Tadhil and Downhead, about	110 ft. seen

Bristol Field Botany in 1912.

IDA M. ROPER.

THE event that stands out in importance far beyond all else that has happened in local botany during the past generation is the publication, early in the present year, of Mr. J. W. White's new *Flora of Bristol*. In this monumental work are recorded the results of thirty years' research and accurate observation in this locality. It is a charming book, free from display and all suspicion of "fine writing;" while the style is easy and fluent; humour is not wanting and introductory essays of great interest precede the more technical portions. Reviewers have received the effort with unanimous commendation; from one indeed it had the high praise of being considered "decidedly the best local or county Flora ever written."

Now, at length, the botanists of our city have at command an exhaustive study of their delightful subject, and can realize in full detail the surpassing goodness of their district as a famous hunting ground for wild flowers in all their fascinating forms.

Even yet, as our author says in his Preface, there can be no finality in such work, however thoroughly it may have been carried out, as the process of addition and emendation is continuous and never-ending. A number of interesting points have been noted during the past Summer that add still more to our knowledge of the Bristol flora; and, following the Society's usual practice in issuing a yearly Report, these are given below. The list, with its accompanying Notes, has been kindly prepared by Mr. White, as on previous occasions.

Meconopsis cambrica Vig. The Welsh Poppy is reported by Mr. F. Samson to have become established about Callow Rocks on Mendip.

Corydalis claviculata DC. This local rarity, favoured by the damp season, developed luxuriantly in increased quantity at the Gloucestershire station.

Scleranthus annuus L. A new locality was discovered in July on Bury Camp, near Moorend, Gloucestershire.

Althæa officinalis L. The great storm of December, 1911, did much damage along the Bristol Channel. At Portishead the sea broke over the esplanade into the northern portion of the new lake, swept away the fences provided for the plant's protection, and buried the Marsh-Mallow ground under an enormous mass of clay and shingle. In repairing the mischief the site has been so much altered that no trace of the *Althæa* is now visible, and it is feared that it may not reappear. Many miles to the southward a new locality has been discovered on the banks of the Brue, near Meare, where the plant grows freely.

Lathyrus hirsutus L. One very fine plant on made ground by the Avon, near Arno's Vale, Bristol.

Potentilla argentea L. In good quantity on grassy ground by Portishead Dock. No doubt introduced, but is doing well.

Prunus domestica L. The season of 1912 has proved a prolific one for fruiting shrubs and trees—raspberry, buckthorn, plum, bullace, &c.—and among the rest our Portishead wild plums are bearing a good crop. These trees have been under observation many years, and are regarded as perfectly satisfactory examples of native *P. domestica*. The student, when interested in this group—sloe, bullace, and wild plum—must not overlook the fact that it is an aggregate made up of a multitude of closely related and variable forms; and that although in their extreme states the three sub-species may appear entirely distinct from each other, they are really connected by a series of intermediates, many of which cannot be named with certainty. This point is clearly brought out in the new French Flora by Rouy and Foucaud. The authors describe between sixty and seventy forms,—varieties and sub-varieties in this *Prunus* aggregate, and lament their inability to class some twelve more, of which the characters seem insufficient. By taking a few strides further in the same direction one would arrive at a “distinctive” name for each individual bush in the country!

Sambucus Ebulus L. One bush in the big withy-bed on the Boyd at Bitton, Gloucestershire; *Miss Roper*.

Jasione montana L. Was reported from Clevedon by the late Mrs. Lainson, but in the absence of confirmation was unnumbered in the *Flora*. Mr. D. Williams now writes that he gathered *Jasione* at Clevedon in 1908, and forwards a specimen. Miss Livett finds that the described locality has since been largely built upon, and doubts if the plant could have escaped destruction.

Symphytum tuberosum L. Is now known in our Somerset division as a probable introduction. There are several patches in a small plantation by the lane-side near Failand House. The plantation may be of less than fifty years' growth. It shelters several garden species.

Veronica hybrida L. Is believed never to have effected a lodgment on the Somerset bank of the Avon before this year, when a few stems were observed on river-side rock. This will be, therefore, the first county record.

Pinguicula lusitanica L. Occurred rather plentifully in a peaty swamp south of Ashcot Station, in August last.

Utricularia major Schmid. This exceedingly rare Bladderwort has been obtained a second time in Somerset from a ditch on the peat a short distance N.N.W. of Ashcot Station.

Carex diandra Schrank. Noticed this summer in an enclosure on Catcott Heath, more than a mile from the original station near Shapwick.

C. vesicaria L. With regret it must be stated that this sedge is in a bad way through trimming of the bank and a rigorous cleaning of the drain or rivulet where alone it grows. Only a little remains, and that did not flower last spring.

Gastridium lendigerum Gaud. The damp season appears to have helped this grass to spring up more abundantly than for a long period. A rocky slope above the Bridge Valley Road is an additional locality.

Uncommon aliens continue to thrive on the city waste lands. Among the more interesting newcomers are *Trigonella gladiata* Stev., found by Mr. Ivor W. Evans, and a new *Solanum*, at present unidentified. *Abutilon Avicennæ*, and *Sisymbrium Columnæ* are still plentiful on Wapping Wharf.

Bird Notes for 1912.

D. MUNRO SMITH.

THE Curlew (*Numenius arquata*) breeds in our district, as I found a nest in a certain boggy spot on the Mendip Hills on May 18th, 1912. I believe this is the first notice of their nesting in our district.

Immature birds, I know, are found along the shore of the Channel in summer, but I do not know of any place nearer than the Mendip Hills affording situations suited to the tastes of the old birds in the breeding season. As Seebohm says, the breeding range of this bird in Britain is similar to that of the Ring Ouzel and Red Grouse.

This bird flies very swiftly away from the nest on the appearance of a human being, and I should never have found the nest but for the near neighbourhood of a bank and a clump of furze-bushes, which afforded me concealment.

While searching for this nest, a snipe (*Scolopax gallinago*) rose, and I found the nest with four eggs. There is no notice of this bird's nesting in our local "Bird List." Towards evening I had many opportunities of hearing snipes "drumming"—a performance peculiar to the breeding season. The birds keep on the wing for a considerable time at a good height, alternately rising a little way, and then dropping with quivering wings, when the peculiar drumming is produced. It is supposed that the noise is made with the wings. The noise might be mistaken for the bleating of a goat.

I have good evidence that snipe nest much nearer the city than the Mendip Hills—near Walton-in-Gordano for instance—and it is very likely that Bristol naturalists have found nests without informing the Society.

The Redshank (*Totanus calidris*) was found nesting in our district last year by a keeper, and I saw a pair in the same spot this year in mid-May. This last was also a record for Somerset.

Report of Meetings.

For the year ending December 31st, 1911.

NINE Meetings were held during this Session, the average attendance at each being 58.

The Subjects introduced were as follows :—

Jan. 19th.—Annual Meeting. Presidential Address by Mr. G. Munro Smith : "Nature's Appeal."

Paper entitled "Beetles as Pests," by Mr. C. T. Gimingham.

Demonstration of arrangement by which the discharge of spores from a *Polyporus* was rendered visible

Feb. 2nd.—Exhibition of Specimens of larva of a Field-bug, by Mr. C. K. Rudge.

Feb. 16th.—Special Lecture by Mr. Grant Lane : "Wild Life in the Bush."

Mar. 2nd.—Papers by Mr. F. de la M. Norris on "Observations on the cystidia in a species of *Coprinus*," and by Dr. W. D. Henderson on "The Parental Care of Animals."

Exhibition of a Pipe Fish, by Mr. C. K. Rudge.

April 6th.—Paper by Dr. A. B. Prowse on "Ice."

May 4th.—Special Lecture by Mr. Stephen Paget on "The Life of Pasteur."

Oct. 5th.—Lecture by Mr. Martin Duncan on "The Romance of Marine Zoology."

Nov. 2nd.—Lecture on "Autumn Tints," by Miss I. M. Roper

Dec. 7th.—Paper by Mr. J. W. Eves on "Geographical Distribution."

Exhibition of specimens of the Green Sandpiper, Redshank, Jack-Snipe, and Knot, by Mr. D. Munro Smith.

There were 5 members and 5 associates elected during the Session, and 9 resignations of membership. The Society lost the valuable services of Mr. Priestley, who resigned his Secretaryship on his appointment as Professor of Botany at Leeds. Dr. W. D. Henderson was elected in his place as Hon. Secretary of this Society.

It will be noticed in the above list that on two occasions (February 16th and May 4th) Special Lectures were given by Mr. Grant Lane and Mr. Stephen Paget respectively. These were well attended and thoroughly appreciated.

GEOLOGICAL SECTION, 1911.

THERE have been seven meetings during the year, when the following papers were read :—

Jan. 26th.—“Lakes,” by the President (Prof. S. H. Reynolds, M.A., F.G.S.).

Feb. 24th.—“Fossil Plants,” by J. H. Priestley, B.Sc.

March 23rd.—“Glacial Periods and their Causes,” by G. R. Holligan, B.Sc.

April 27th.—“The Lithology of the Carboniferous Limestone of Burrington Combe,” by the President (Prof. S. H. Reynolds, M.A., F.G.S.).

Oct. 19th.—“Some Famous Geological Controversies,” by the President (Prof. S. H. Reynolds, M.A., F.G.S.).

Nov. 9th.—“A Geological Holiday in Skye,” by C. I. Gardiner, M.A., F.G.S. (of Cheltenham College); this paper was illustrated by a relief model of the island.

Dec. 7th.—An Exhibition Meeting.

At the end of the year there were 46 members, but 8 of them joined under the new rule which admits students of the University as members of the section separately from the Bristol Naturalists' Society.

I have to record the death of Dr. T. D. Nicholson, who had been a member of the section for over 10 years, and took a great interest in its meetings.

The Financial Report shows a total receipt of £6 17s. 6d., including a balance of £3 5s. 0d. brought forward from the previous year. The expenditure amounted to £6 16s. 3d., which included £2 voted at the February Meeting towards the cost of printing the Proceedings of the Bristol Naturalists' Society, leaving a balance of 1s. 3d. to be carried forward to next year.

B. A. BAKER, F.G.S., *Hon. Sec.*

ENTOMOLOGICAL SECTION.

ONE Meeting only was held during the year, on November 16, when Mr. Charbonnier brought forward his Local List of Diptera, covering an area bounded on the North by Painswick and on the South by Shepton Mallet. 690 species were recorded, and Mr. Charbonnier read the introduction and many interesting notes from the list, which consisted of 40 fcap. pages. It was unanimously resolved to ask the Society to publish the list in the Proceedings, and Mr. Charbonnier was warmly congratulated upon his achievement.

Mr. Griffiths exhibited a spider's nest from Mombassa, B.E. Africa, also specimens of *Parnassus Appolloninus*, *P. Romanosi*, *P. Staudingeri*, *P. Intermedius*, *P. Nebulosus*, all from Turkestan, and *Doritis Appollinus*, Europe.

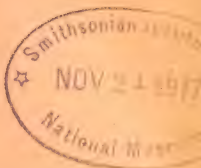
Hon. Secretary showed 2 *Crymodes exulis*, Shetland and Unst; 3 *Xanthia ocellaris*, Thames Valley; *Macroglossa fuciformis*, Brockley Coombe; and *Trochilium bembeciformis*, Abbotsbury.

CHARLES BARTLETT, *Hon. Sec.*

FOURTH SERIES, VOL. III., Part III. (Oct., 1913, issued for 1912.)

Price 1/6.

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AND
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"Rerum cognoscere causas."—VIRGIL.

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For information concerning the Bristol Naturalists' Society generally, or concerning their Proceedings, please apply to the present Hon. Secretary and Editor—

DR. O. V. DARBISHIRE,

THE UNIVERSITY,

BRISTOL.

All Books, Pamphlets, Reports of Proceedings sent by way of exchange, gift or otherwise, should be sent to—

DR. A. B. PROWSE,

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Prof. Sydney Young, D.Sc., F.R.S., Trinity College, Dublin.

List of Members

(completed up to July, 1913).

A Signifies Associate Member.

P Signifies those who have contributed Papers printed in the "Proceedings" of the Society.

L Signifies those who have compounded for their Annual Subscription.

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REPORT OF THE COUNCIL

To December 30th, 1912.

NO Report was published covering the year 1911.

At the end of 1909 there were 149 members, at the end of 1910 there were 137, and the end of 1912 there were 124. Of these 85 were full members and 39 associate members. In addition the Society has 15 honorary members on its roll, and a few members of sections which are not also members of the Parent Society.

The average attendance during the meetings of the last year was just under 50.

During the year, in November, the Proceedings for 1911 were published, representing Series IV., Vol. III., Part II., of the Proceedings and covering 88 pages.

The following meetings were held during the year :—

Jan. 18th.—Presidential Address by Dr. G. Munro-Smith.

Feb. 1st.—Dr. Darbishire : "Plants of the Coal Age."

Mar. 7th.—Dr. Henderson : "Deep-sea Animals."

May 9th.—Joint Meeting with the University Botanical Club for the Exhibition of objects of interest.

Oct. 3rd.—Dr. Prowse : "Living Stick Insects."

„ Dr. Darbishire : "Vitality in *Yucca gloriosa*."

„ Miss Ida M. Roper : "Wild Plums."

Nov. 8th.—Professor C. Lloyd Morgan : "Bergson on Instinct and Evolution."

Dec. 5th.—General Exhibition Meeting.

LIBRARY REPORT

For the Year 1912.

DURING the year 18 members have borrowed books, again a very small proportion of the total ; and the number of books taken out was 100.

Of the volumes borrowed, twenty were still out at the end of the year ; and another, which was borrowed in April, 1909, has not yet been returned.

We again wish to remind one or two members that, when they return books, the *date of return* should always be entered on the counterfoil in the record-book.

Thirty-two volumes have been bound at a cost of 2/4 each.

We have received during the year, from the Corresponding Societies, four bound volumes and 247 unbound parts of current publications ; and also four parts to complete series of earlier dates.

To the following donors of books we offer our sincere thanks :—

BRITISH ASSOCIATION, for the "*80th Report*," Portsmouth, 1911.

HIERN, W. P., M.A., F.R.S., for "*Rubus in Devon*," 1911.

JANET, MONS. CHARLES, for three Entomological pamphlets, 1910, 1911, 1912.

PROWSE, ARTHUR B., M.D., for "*Third Report of the Botanical Committee of the Devon Association*," 1911.

PROWSE, ARTHUR B., M.D., for paper on "*Dracænas*" (from the '*Floral World and Garden Guide*').

WOODRUFFE-PEACOCK, REV. E. A., for "*Frequency in Floral Analysis*," 1912.

UNIVERSITY COLLEGE, LONDON, for "*Catalogue of Periodical Publications in Univ. College (London) Library*," 1912.

UNIVERSITY OF CHRISTIANA, for three pamphlets (Geological, &c.) 1909.

The following Periodicals have been received from members in continuation of their kindness during past years :—

British Association Report (80th), 1911, Portsmouth, from F. F. Tuckett, Esq., J.P.

"*Entomologists' Monthly*," for 1911, and Jan.—June, 1912, from the Entomological Section, B.N.S.

"*Linnean Society, Journal and Proceedings*," 5 parts, from J. W. White, Esq., F.L.S.

"*Palæontographical Society's Memoirs*," Vol. 64 (1910), and 65 (1911), from the Geological Section, B.N.S.

"*Philosophical Transactions of the Royal Society*," Series B, Vol. 202, from Dr. Sydney Young, F.R.S.

"*Geological Magazine*," for 1911 (and some back parts), from the Geological Section, B.N.S.

We have received the following Subscription volumes and part :—

From the RAY SOCIETY, " <i>British Tunicata</i> ," Vol. III.,	} for
1912 	
From the RAY SOCIETY, " <i>British Desmidiaceæ</i> ," Vol. IV.,	
1912 	

From J. W. White, Esq., "*The Flora of Bristol*," 1912.

From Messrs. Taylor Brothers, *Taylor's "Mollusca"*, part 19, 1912.

There is no alteration in the EXCHANGE LIST.

ARTHUR B. PROWSE, M.D., *Hon. Librarian.*

IDA M. ROPER, F.L.S., *Hon. Sub-Librarian.*

January 16th, 1913.



EXCHANGE LIST.

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 Barrow Naturalists' Field Club
 Bath Natural History and Antiquarian Field Club
 Belfast Naturalists' Field Club
 Birmingham Natural History and Philosophical Society
 Bristol Corporation Public Libraries (Subscription)
 Bristol Museum and Art Gallery
 British Association
 British Museum (Natural History), S. W.
 Cardiff Naturalists' Society
 Chester Natural Science Society
 Clifton Antiquarian Club
 Clifton College Scientific Society
 Cornwall, Royal Geological Society of
 ———, Royal Institution of
 ———, Royal Polytechnic Society
 Cotteswold Naturalists' Field Club
 Ealing Scientific and Microscopical Society
 Edinburgh Geological Society
 ——— Royal Botanic Society
 Essex Field Club
 Geological Society of London
 Geologists' Association
 Glasgow Geological Society
 ——— Natural History Society
 ——— Philosophical Society
 Hertfordshire Natural History Society and Field Club
 Liverpool Geological Association
 ——— Geological Society
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 Manchester Literary and Philosophical Society
 ——— Microscopical Society
 ——— Museum Library
 Marlborough College Natural History Society
 North Staffordshire Field Club
 Norfolk and Norwich Naturalists' Society
 Nottingham Naturalists' Society
 Plymouth, Marine Biological Association of the United Kingdom
 ——— Institution and Devon and Cornwall Natural History Society
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January, 1913.

Hon. Librarian.

The HON. TREASURER in Account with the BRISTOL NATURALISTS' SOCIETY.

DR GENERAL ACCOUNT FOR THE YEAR ENDING DECEMBER 31ST, 1912. CR.

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To Entrance Fees ..	..	..	1 0 0	By Miss Roper—Excursion Expenses ..	..	..	0 5 0
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Bristol, February 6th, 1913.

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Hon. Secretary—J. W. EVES, Agricultural Department, University of Bristol,
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White, J. W., F.L.S.		

OWING to the small number of members—the number, unfortunately, having been reduced to seven—it was not thought desirable to hold any meetings during the Session 1911—1912. It is, however, strongly felt that the Section should not be disbanded altogether after its existence of more than thirty years; but should be set in motion once more and continued on a firmer basis, both for its own welfare and for the benefit of the Parent Society.

I therefore beg to state that all those who are interested are cordially invited to join the Section and to send in their names for membership to me.

J. W. EVES, *Hon. Sec.*

GEOLOGICAL SECTION.

Members—

Allen, G. A. Blackmore, J. C., F.G.S. Blood, George Barke, H. F. Baker, B. A., F.G.S. *Biggs, Miss W. E. *Bacon, A. P. Body, Thos. Cay, Arthur Cann-Lippincott, R. C. Capron, G. H. Dixon, Miss G. *Edwards, Miss G. M. *Edwards, T. G. Fortey, Chas. Green, Upfield, F.G.S. *Grant, E. H. Hippisley, E., C.E. Isaac, C. Kemp, J. T., M.A. *Kirby, G. E. *Longman, Miss M. Lloyd Morgan, C., LL.D., F.R.S.		Morgan, T. Mappin, S. W. *Mortimore, Miss D. M. Matthews, H. E. Norman, G. Prowse, Dr. A. B. Reynolds, Miss J. B. Richardson, F. Read, E. H. Reynolds, Prof. S. H., M.A., F.G.S. Stephens, G. *Smith, C. C. Tutchet, J. W. *Tincknell, G. M. Underhill, J. T. Vaughan, Dr. A., F.G.S. *Wallis, F. Winwood, Rev. H. H., F.G.S. Wickes, W. H. Wright, Miss A. H. M. Woodey, E. L. Wood, Miss K. M.
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THE year commenced with 45 members, one of whom has since resigned. There have been seven meetings, at six of which papers have been read, mostly illustrated by lantern slides and specimens exhibited in connection with the subjects of the papers. The last meeting was an exhibition, when many objects of geological interest were exhibited. The following is a list of the papers read :—

January 26th, 1912.—“The Bristol Bone Caves and their Inhabitants,” The President.

February 23rd, 1912.—“The Geology of the Yorkshire Coast,” L. Richardson, F.G.S.

March 14th, 1912.—“Concretions,” by Miss Agnes Bamber.

May 16th, 1912.—“Recent Work on the Lower Palæozoic Rocks of Wales,” The President.

October 18th, 1912.—“The Physics of the Earth’s Crust,” C. C. Smith.

November 21st, 1912.—“With an International Party in the N.W. Highlands of Scotland, September, 1912,” The President.

December 12th, 1912.—An Exhibition Meeting.

At the first meeting of the year Professor S. H. Reynolds, M.A., F.G.S., was re-elected President and B. A. Baker, F.G.S., Hon. Sec. for the coming year. There was an average attendance of 14 members and friends.

The Secretary presented the balance sheet at the first meeting in the new year, which showed a balance in hand of 17/9.

The total receipts amounted to £5 15s., and a balance of 2/6 brought forward from last year. The expenditure amounted to £4 17s. 3d.

B. A. BAKER, *Hon. Sec.*

December 31st, 1912.

ENTOMOLOGICAL SECTION.

THE Season of 1912 being so unfavourable for Entomology no excursions of the Section were taken, and from various causes only informal meetings were held.

The International Congress of Entomology was held at Oxford from August 5th to 10th inclusive. Messrs. G. C. Griffiths and C. Bartlett attended, so that the Bristol Naturalists’ Society was represented.

CHARLES BARTLETT, *Hon. Sec.*

ANNUAL ADDRESS,

“THE POINT OF VIEW,”

BY THE PRESIDENT—DR. G. MUNRO SMITH.

I WISH to detain you a few minutes whilst I endeavour to give you my thoughts upon some of the different ways of observing and recording Natural History.

(1) First there is the obviously supernatural method. This I only wish to touch upon, and that as lightly as I can. Whatever our faith may be, whatever we may feel as to the origin of things, we cannot bring this into the study of Natural History without great caution. The reason is pretty obvious. We notice an animal or plant behaving in a certain manner—we describe this, and then avoid explanation by saying: This is beyond us, we can give no reason for it; it is the will of the Creator; the creature is obeying Him and is guided by Him. This, as a statement, surely everyone is justified in making; but if this is brought into Natural History there must necessarily be nothing further said on the subject. You stop observation—you appeal at once to something beyond our reason. Therefore we find, as we should expect, that the great advances in science have been made by those who in their investigations have used their reason and endeavoured to explain things in terms of human language. However far they have to stretch they have not tried in their explanations to stretch into the Infinite.

This does not of course mean that the great naturalists have not been religious men. It merely means that they have kept their religious beliefs out of their scientific investigations.

Here one may touch upon a somewhat kindred subject, viz.: the explanation of phenomena by attributing them to the work of spirits or beings from another world, or ghosts of the departed.

Luckily this has not held much ground of late in Natural History, although still used by some as a means of explaining certain phenomena.

A house is said to be haunted; visitors have water dashed in their faces, see lights, and hear weird sounds. Mr. Elliot O'Donnell and others explain these by various supernatural means—not to the satisfaction of the majority of scientists. The camera even, that very prosaic and usually truth-telling instrument, is made to show strange things.

This, the supernatural method, must be condemned as a means of scientific explanation if we wish to do any real work in Natural History.

(2) There is the picturesque and imaginative standpoint. It is always well that a naturalist should have an imagination, if you mean by that the power of putting yourself by an effort of the mind into the position of the animal, for example, that you are investigating, with this important proviso, that you must not start with the assumption that every man, woman, child, and animal, even every insect, thinks and feels as you do.

Unfortunately this is a very common and a very pernicious habit ; and many otherwise sound men have done more harm than good as naturalists by adopting it.

Richard Jefferies rather fell under its sway ; Mr. Grant Allen certainly did ; and the monthly illustrated journals and a great deal of to-day's literature are full of it. Take one or two examples.

Mr. Grant Allen described very well some of the habits of the Butcher-bird. But he biassed his own mind and that of his readers from the outset by saying that the Butcher-bird was cruel. This led him to give, to my mind, a totally wrong impression. He took great pains to describe the horrors of the Butcher-bird's larder ; he describes a shrew-mouse impaled on a long thorn, slowly torn in bits, and suffering torture for days, so that at the end of his description one is inclined to think that the Butcher-bird is a nasty beast, especially as Grant Allen omits to say that the bird is merely following the instinct of his race. He rather implies that he knows full well what suffering he is causing. All this is very objectionable. The Butcher-bird's larder is not always quite a pleasant sight, but it is not as he describes it, I think. And it is absurd to call the animal cruel. He is absolutely free from a moment's thought on the subject of his victim's sufferings.

Then a modern writer, much praised by reviewers, has given many well-written pictures of animals in a wild state. He puts human thoughts and passions and feelings into all of them. The consequence is that nature appears in his writings merely the workshop of a cruel devil, where animals torture and kill each other, and cold and hunger torture the rest.

This much to be condemned method is the result partly of insufficient observation, but still more of starting with the idea that all creatures should be judged and measured by a human standard. It is in fact not imagination, but the serious *want* of it.

(3) Then there are exaggerative and other inaccurate methods, the most fatal of all, and the easiest to fall into. No one can read old travels without being much struck by this : a large bird is described as yards across the wings, the whale is as big as a mountain, and sharks' mouths are wide enough to swallow a man whole. Baron Munchausen is reproduced again and again.

The frankly exaggerative method has of course nothing to be said except in the way of condemnation ; but great mistakes and unconscious exaggeration arise very easily, chiefly from four causes : (1) preconceived ideas, (2) mistakes of the senses, (3) delay in registering result of observations, and (4) insufficient observation.

As an example of the danger of a PRECONCEIVED IDEA, I may give the well-known incident of the fire at the Crystal Palace. On December 30th, 1866, the north wing was destroyed by fire, causing a loss of property estimated at £150,000. Thousands of spectators watched the fire, and a report got abroad that a tame monkey had escaped and was on the roof. To the horror of the spectators it was seen by hundreds of the expectant crowd dancing about, waving its arms, and finally sinking in the flames. Yet no monkey was there at all, and what the crowd saw was the result

of their preconceived ideas. They *thought* the monkey was there and then pre-*saw* it.

In the same way, if we *expect* any natural phenomenon to happen, we therefore often think it *is* happening.

2. MISTAKES OF THE SENSES. This, of course, is a known source of fallacy. Our eyes are easily deluded, especially as to size and distance. Estimation of the height of a top hat, of a man's breadth across the shoulders, of certain colours, of rapidity of movement are all very apt to be erroneous. Hence the great importance of measurement, emphasized by the saying, "Science is measurement."

The curious delusions of sight are well illustrated by showing people any object, letting them look at it well, and then taking it away and asking them to describe it or draw it. The several descriptions are very striking examples of how differently a thing appears to different people.

Here, again, previous knowledge makes all the difference ; if we *know* our object before, a short examination may enable us to give a very accurate description or representation. So it has been said that to Newton and Newton's dog "Diamond" what a different Universe appeared, although the picture on the retina was probably the same in both.

Deficiency of one or more senses, even if the others are acute enough, seems to lead to imperfect judgment. The senses help each other, so that smell without sight, for example, seems to be severely handicapped

3. DELAY IN REGISTERING OUR IMPRESSIONS. This has lead many of us into difficulties. It is very noticeable in reports of medical and surgical cases, for instance. I once operated on a patient at the Infirmary, and the Resident Officer who wrote out the report deferred it for two days. When it was done it departed so far from the fact that I could not recognise the description as in any way a report of what I had done.

I have noticed in my diary that if a slight delay occurs I have great difficulty in giving a correct description of any natural phenomenon.

Hence it is of great importance to make your notes on the spot.

These three—bias, mistakes of the senses, and delay in registering impressions—lead to much exaggeration and incorrectness in other ways.

There is a method of looking at nature, a mental attitude towards it, which we may call the Poetic Attitude. This is too large a subject to deal fully with, but it is immensely important, and we must say something about it.

I may say at once that it may easily become a source of danger, and cannot be looked upon as an ally of the real naturalist unless carefully handled. It can, moreover, seldom be used to prosaic people without misleading them.

People who take a metaphor quite literally, as many do, should never have any poetry thrown into a description of anything like Natural History.

The metaphorical style is, of course, consistent with scientific accuracy. Tennyson, who came under the influence of science—and, to his honour be it said, always was open to the impression of the scientific spirit of his age—Tennyson is full of metaphor in his most scientific poems. Thus, instead of speaking of the sun sinking in one of his well-known pieces, he says—and I wish to call attention to this piece :

“ Move eastward, happy earth, and leave
Yon orange sunset waning slow ;
From fringes of the faded eve,
O happy planet, eastward go ;
Till over thy dark shoulder glow
Thy silver sister world—”

Now, every line of this contains a metaphor, yet it is strictly true.

Good poetry indeed is not vague and indefinite, but exact. As Professor Dowden points out, two of our greatest poets, Dante and Milton, were almost laboriously accurate in their descriptions, so that a guide book, *Celestial or Infernal*, as the case might be, could be compiled from their *Inferno*, *Paradiso*, and *Paradise Lost*.

True poetry indeed follows the advance of science. We sometimes think rather sadly that the great tide of science, by washing away old landmarks, has prevented future poets from the high achievements of their predecessors. This has been surely confuted by men like Goethe and Browning—but on theoretical grounds there is plenty of room for poetical thought in the consideration of the wonders of modern science. What can be more entrancing for instance, than to let one's fancy wander back into the dim eternity from which our planet and our race have sprung—to picture our remote ancestors, and fancy that mysterious evolution of body and mind going on through the countless ages—and with all this memory and accumulated ancestry at our backs, to look forward and endeavour to cast the horoscope of the future ; there is plenty of room for the poets of the future in all this !

Speculation in fact is peculiarly the poets' province, and legitimate speculation and re-construction are frequently wanted in science.

Many poets have been extremely good observers. It is rare to find any serious mistake in Tennyson, Wordsworth, Milton, Burns, or Shakespeare. Goethe, it is well known, was a good instance of a poet who could accurately observe. His imagination helped him, but it led him astray in the subject of physics and not only this, but made him unjust and even ridiculous in his estimation of Sir Isaac Newton.

He knew no physics and very little mathematics and thought that physics could be taught without mathematics at all. His idea was that “ Nature revealed herself to the patient observer,” (*Lewes's Life*, p. 344), and he says, “ And what she does not reveal to the mind (*geist*) will not be extorted from her by levers and screws.” Compare this statement with the words of the

mathematical Carlyle. "Equitable Nature herself, who carries her mathematics and architectonics not on the face of her, but deep in the hidden heart of her. Nature will be wholly against him if he constrain her not."

The poet thought that Nature lay as an open book to the student. The English thinker looked upon her as one who kept her secrets and *had* to have levers and screws applied to extract them.

Goethe used the *à priori* method—but it must not be supposed that he did not experiment and study. His investigations and deductions in Comparative Anatomy and Botany indicate this and his "Metamorphosis of Plants" shows how an imaginative intellect may place a man a hundred years ahead of his contemporaries.

It may be noted that Goethe's discovery of the Premaxilla in man was not accepted for nearly 40 years by anatomists and he was naturally indignant at the determined adhesion to old ideas. He uses this remarkably brilliant metaphor. "The phrases men are accustomed to expect incessantly end by becoming convictions and *ossify the organs of intelligence*." (Vicq d' Azyr. made the discovery first, but it is almost certain Goethe knew nothing of this).

As to the researches on the metamorphosis of plants, Dr. Hooker, who studied the subject of priority carefully, thinks that there is nothing in the writings of Linnæus or Wolff (who formulated the theory) "that detracts from the merits of Goethe's re-discovery."

Goethe's other great speculation, the vertebrate theory of the skull is not now accepted for the most part by anatomists, but the great principal of "Unity of type," the most important basis of our modern views of Comparative Anatomy was clearly enunciated by him.

In fact, his writings are full of magnificent forecasts of generalisations for which eminent zoologists have won subsequent credit. Listen to this:—

"Here then we have a great poet, who by applying his imagination to his somewhat limited number of facts made important scientific discoveries—as a scientist his method was wrong. He did not, like Darwin, accumulate a vast number of observations and then make his deductions—but his imagination ran ahead and the truth flashed almost suddenly upon him."

In his case we may say that the standpoint of the poet is in many ways a good one from which to study Nature.

The poetic standpoint must not be confused with the treatment of natural scenes and phenomena by the poets. In this respect—if they are real poets—and not the wishy washy, sentimental, fourth rate creatures who now by the hundreds are claimed as such, their descriptions are often extremely good. They have the important power of expressing their thoughts in beautiful and correct language, no small advantage. Tennyson on the Nightingale, for instance, is remarkably sound, as an observer and a poet

Of the metaphysical standpoint I am not in any way qualified to speak. But it seems to me to be one of the most interesting and at the same time one of the most "foreign," if I may use the word, of all points of view. It explains matters on a level which carries the subject into a high rarified atmosphere where ordinary work on Natural History is not easy. . . . It is a standpoint which can only be taken by a man accustomed to abstract thought. In his hands it may become a most illuminating guide.

These are only a few of the many sides from which natural objects and phenomena can be studied. And the truth lies not in one point of view alone. We have, it seems to me, no right to exclude the poet, or the metaphysician, or the theologian from the field. They give impressions of what they see and think, which we should examine with open and candid minds. If we can only look upon an animal or flower from one point of view, however exalted that may be, we are apt to be imperfect in our judgment. Wordsworth was a type of a fine intellect who did not allow any of the sides of Nature, except two or three to appeal to him. He was therefore, in spite of his magnificent thoughts, narrow and rather bigoted. He realized the grandeur, the beauty, the appeal to the Spirit. He could not and would not look at the thing from the standpoint of the minute observer and the investigator. "We murder to dissect," he says—and we ought really to have a grain of sympathy with the man who could "peep and botanize upon his mother's grave." The bare statement of the fact sounds horrible—but it really would be no disrespect to the departed to be interested in a beautiful or rare plant which had been sown on the grave from "the lap of some wandering wind."

Truth is many sided. Ruskin says somewhere that he never considered he had really thought out a subject until he had contradicted himself at least three times—and a man may be very definite about a thing if he looks at it from one point of view only, but uncertain if he looks at it from many—so, we falter where we firmly trod as our knowledge and powers develop.

The outcome of these brief and rambling notes is this; that many standpoints are legitimate in science. There is room for the merely accurate observer, the statistician, the abstract thinker, the metaphysician, the poet. The only men there is not room for are the persistently or wilfully inaccurate.

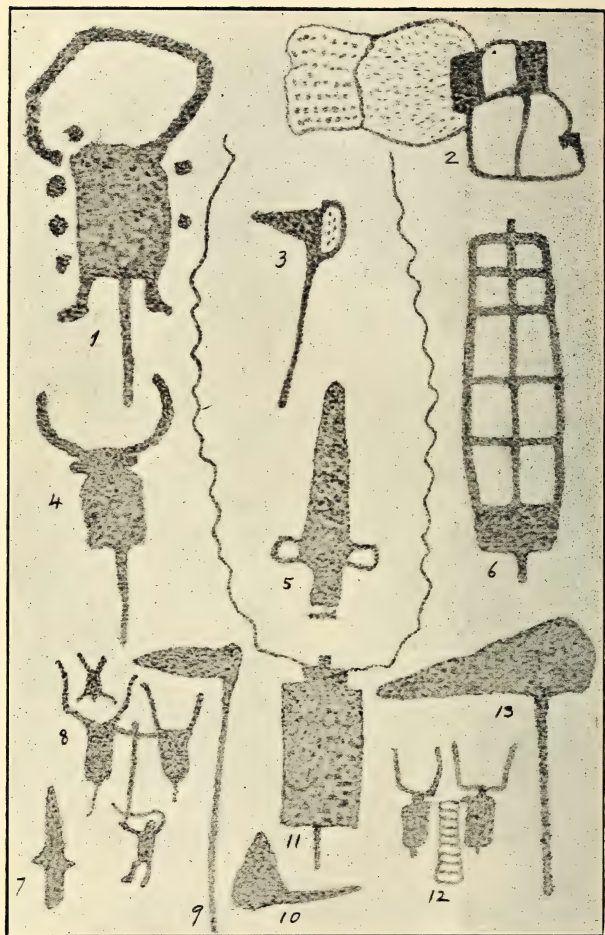


PLATE I.—ROCK FIGURES IN THE MARITIME ALPS.

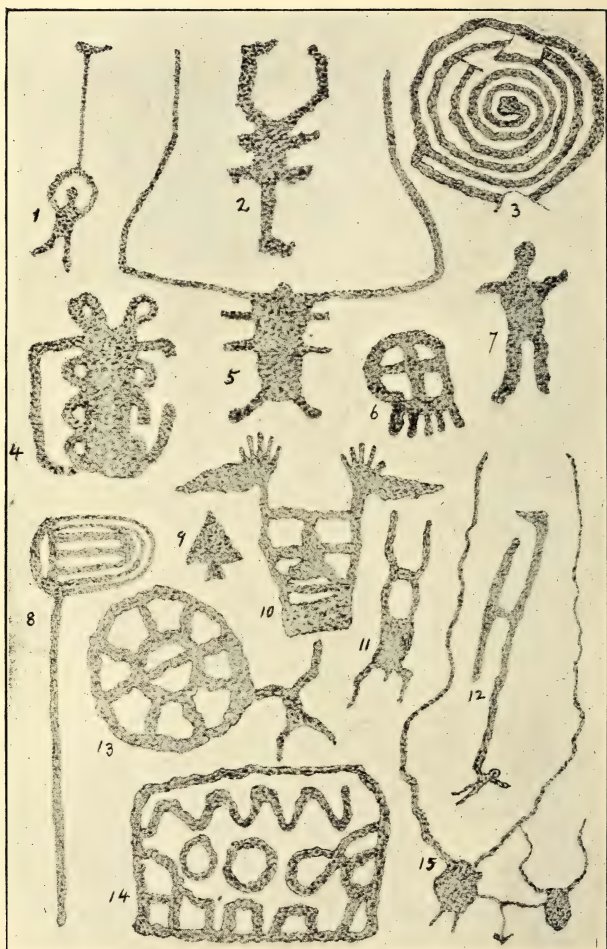


PLATE II.—ROCK FIGURES IN THE MARITIME ALPS.

The Rock Figures of the Maritime Alps.

By CEDRIC BUCKNALL, Mus. Bac., Oxon.

THERE are in various parts of the world figures engraved on the smooth surface of rocks, of whose age and authorship little is known. These are mostly representations of animals, and are formed either of dots made by repeated blows with some instrument or of incised lines.

Of the first method there is a good example in the British Museum, on a piece of rock brought, I believe, from South Africa; this is a well-drawn figure of an animal, with the body sculptured all over.

Some of the South African figures, engraved by the Bushmen on very hard rocks, are deeply corroded by weathering, and are calculated to be 2000 years old.

In Upper Egypt there are incised figures of animals, which, from long exposure to the weather, are covered with a brownish coating like that of the original rock. Inscriptions cut in the same rock, known to be 5000 years old, still look quite fresh.

It is not generally known, however, that within two days journey from England there is a district in which rock engravings abound, and which, for an area of equal size, is perhaps unequalled in interest in the whole world.

This district is at the head of four valleys directly under the summit of Monte Bego, one of the highest mountains of the Italian Maritime Alps, and covered with snow for a great part of the year. Monte Bego, with another conspicuous summit, that of the Gran Capolet, is situated in the district of Tenda, not far from the picturesque old town of that name. These mountains are near the French frontier, and are visible to the traveller on the Mediterranean coast, from which they are little more than twenty miles distant in a direct line. From Ventimiglia a road, which affords a continual series of magnificent views of mountain, gorge, and river, leads up the valley of the Roya to San Dalmazzo di Tenda, the village nearest to the valleys containing the rock engravings, the distance from Ventimiglia being about twenty-seven miles. San Dalmazzo may also be reached from the north by way of Tenda.

From this village a road, which soon becomes a mule-track, leads towards the west, and, after about two-and-a-half hours walking, La Miniera di Tenda is reached. From this point several routes lead to the valleys under Monte Bego.

The Vallone delle Meraviglie—the Valley of Wonders—with several lakes called the Laghi delle Meraviglie, is reached by continuing westwards past the Val Valauretta. Cultivation now ceases, and the valley known as the Val d'Inferno, after a while opens out into a wide and desolate region covered with rocks. Here, about six hours walk from San Dalmazzo, the first rock figures are found. If, instead of following this route, the traveller turns to the north from La Miniera into Val Casterino, he reaches

in about one hour the entrance to Val Fontanalba, at the head of which rock engravings are found in great numbers. For our knowledge of these we are indebted almost entirely to the researches of Mr. Clarence Bicknell, who for the last fourteen years has spent a part of each summer in drawing and taking rubbings of the figures. It is through his kindness that my wife and I were enabled, in August, 1911, to spend a week in Val Casterino, to collect a large number of the rare plants with which this most interesting region abounds, and above all to visit and examine for ourselves examples of the various types of figures on the rocks of Val Fontanalba.

The result of Mr. Bicknell's work, together with an account of earlier researches, is given by him in "The Prehistoric Rock Engravings of the Italian Maritime Alps," the second edition of which was published at Bordighera in 1911, and to this I am indebted for the account contained in the present paper.

The sculptured rocks consist of chloritic schist, polished by glacial action, and mostly covered with a varnish-like ferruginous coating, ranging in colour from pale ochre to brilliant vermilion. The engravings extend over an area of about seven square miles, at an altitude of 6600 to 8000 feet. The figures are nearly all made by repeated blows, probably of a flint or other stone implement, which Mr. Bicknell has found is more suited for the purpose than a metal tool, but there are a few figures with incised lines. No trace of any implement, either of stone or metal, has been found. The blows have generally cut through the coloured surface, so that the figures are often quite conspicuous from the different colour of the underlying rock, but when the surface has weathered off, they are only seen with difficulty and when the light is favourable. Occasionally the figures are cut on rocks without the ferruginous coating.

The first written account of the engravings was given by the historian Giofreddo in the "History of the Maritime Alps," published in 1650. He had heard of the figures from the parish priest of Belvidere, in the Vesubie Valley, and says, "The above-mentioned lakes are called 'The Lakes of Wonders,' because near to them, to the wonder and amazement of beholders, are to be found various rocks of different colours, smooth and slippery, which are engraved with a thousand figures, representing quadrupeds, birds, fish, mechanical, rural and military implements, with historical and fabulous events Laurenti writes that among other things are to be seen the figures of shields, of the ancient Labarum with the eagle, and of other Roman ensigns on long poles. From which it is to be believed that the figures were done many centuries ago, and that the authors of these spirited jokes were probably only shepherds and herdsmen who wished to while away their idle hours."

We do not hear of the figures again until 1821, when a Mons. Fodéré went to see them, and described them as sculptures of elephants, camels, chariots, and cuneiform inscriptions made by

the Carthaginians. These M. Elisée Recluse, in 1864, pointed out to be nothing more than the result of erosion and glacial action; but a glance at copies of the figures will shew how very far from the truth M. Recluse's dictum was.

In 1868, Mr. M. Moggridge encamped in the Miniera Valley with the intention of taking rubbings or casts, but the weather being stormy he could only make pencil drawings. He read a paper at the International Prehistoric Congress at Norwich, which was published with 120 figures. Mr. Moggridge thought that the figures might be hieroglyphics placed together to form words.

In 1877, M. Emil Rivière, sent by the French Government to study the region, encamped for twelve days in the Vallone delle Meraviglie. He made drawings or squeezes of 408 figures, of which 50 were published.

In 1878, M. Edmond Blanc, of Nice, saw some of the figures, and suggested that "they were cut by a superstitious people who adored a terrible divinity supposed to reside in the Val d'Inferno, or upon Monte Bego"; but in 1884, Signor S. Navello states his belief that the figures were made by shepherds in their hours of repose, and ridicules M. Blanc's suggestion.

In 1885 we first hear of the Val Fontanalba, when Prof. Celesia, of Genoa, endeavoured to explore this region, but was driven back by bad weather. From the description of friends who had been there, the sound of the thunder, and the sight of the swollen river, he described the Val d'Inferno as a place of indescribable horror. He then thought of visiting Val Fontanalba, which was apparently known only to the shepherds. He was guided to some of the figures by two goatherds, and a good many fair drawings were made and published, together with a paper. These Prof. Celesia considered to represent "heads of ruminants, snails, serpents, skins of beasts, nets, primæval implements . . . figures of men in strange attitudes."

In June, 1881, Mr. Bicknell visited the Meraviglie, but the rocks were so covered with snow that he saw very few figures. In September, 1885, he again went there, and was able to make about 50 sketches. But in 1897 he commenced spending the summers in Val Casterino, and it was then that he heard of the figures which were near at hand in Val Fontanalba. Here, in several excursions, he made 450 small drawings, and then, in thirteen days, 211 rubbings. Some photographs were taken, some of which are reproduced in his book. Unfortunately, no cameras are now allowed in the district, on account of the numerous forts and batteries with which the surrounding hills are guarded.

In 1898, 538 rubbings were made and 100 photographs taken. Two detached pieces of rock, each containing a horned figure, were found, and one of these was sent to the British Museum.

In 1901 figures were found in Val Valauretta which had never been seen before, except by the shepherds. In this year also rocks in Val Fontanalba, from which the coloured surface had worn off, were found to contain numberless figures. These were still visible, but not so distinct as on the coloured rocks.

Up to the time of the publication of the second edition of the "Rock Engravings," Mr. Bicknell and his assistant, Luigi Pollini, have copied 10,600 figures.

Mr. Bicknell says that one rock in the Vallone delle Meraviglie deserves especial mention: "On it is one of the largest and most intricate figures and curved lines. The southern slope is yellow and polished, with numerous figures which are clearly visible; but on the northern side, where the colouring has been worn away and the surface is grey and much weathered, it is indeed a 'Wonder.' Although most people would pass it unnoticed, it is completely covered with figures, many of which have not been visible for centuries until we ourselves brought them to light by clearing away the coarse grass sods at its base."

Although a large number of the figures clearly shew what they were intended to represent, many others are difficult to assign to any known animal or implement, and it is interesting to read what former writers have thought of them.

M. Rivière finds heads of oxen, goats, and deer, but has only seen one with ears; Signor Navello, figures of sheep, chamois, ibex, dogs, and birds; Mons. Blanc, stags, aurochs, eland, ibex, mouflon, roebuck, chamois, heads of the ram, goat, and ox, and skins of deer and lynx; Prof. Celesia, snails and serpents. Mr. Bicknell says, "to them we might ourselves add beetles, scorpions or lobsters, centipedes and bats, which some of the Fontanalba figures strangely resemble, were it not that we do not think that the sculptors intended to make drawings of all these creatures."

The size of the figures is from five to eight inches, but some of them have horns which are greatly exaggerated in length, and so the entire figure is of much larger dimensions.

Besides representations of animals, there are numerous figures of weapons and implements in the Meraviglie: swords, daggers, javelins, picks, and hammers. One of these is seven inches long, with a handle nearly six feet long. Some of the geometrical figures have been compared to nets and hurdles. M. Clugnet suggests that a number of them are like the nets of twisted straw used for carrying hay down from the mountains.

In Val Casterino there are a few houses and a ruined chapel. One of the houses was built by Mr. Bicknell, in a beautiful situation, close to the Fontanalba torrent which here comes rushing down the steep hill-side.

In the wild garden on the banks of the stream, amongst the rocks and in the boggy places, hundreds of the plants which inhabit the neighbouring valleys and mountains flourish, some planted, but a great many native. Here Mr. Bicknell spends several months in each summer studying the rich flora of the district, and making excursions to the region of the rock engravings, which is easily accessible from this point.

After spending a few days at the beginning of August botanizing in this delightful valley, we were, early one morning, conducted by Mr. Bicknell and his assistant Luigi Pollini to the Fontanalba rocks. A stiff climb of twenty minutes led us to a nearly level

and meadow-like part of the valley, where Monte Bego comes into view. Further on we again began to ascend, finding many interesting plants by the way, and at length reached a beautiful little lake—the Lago Verde—in the midst of larches and huge masses of rock. Soon after passing the lake we came to rocky slopes almost entirely devoid of trees or bushes, which extend towards Monte Bego, and here the rocks are everywhere more or less covered with engravings. One of the first pointed out to us was a circle on a corroded rock, so faint as to be scarcely distinguishable, but more easily seen when the sun's rays strike the rock obliquely. Proceeding on our way we saw figures of oxen, some with very long horns, men with oxen and ploughs, implements and geometrical figures.

After a lunch under one of the few pine trees which are found beyond the Lago Verde, we left Mr. Bicknell at work on the rocks, and were guided by Luigi Pollini to the "Napoleon Rock," which lies at some distance from the lake at an altitude of about 8000 feet. To reach this we had a stiff but quite easy climb over steep, broken, rocky ground to a scree, where we saw for the first time large tufts of the beautiful *Viola nummularifolia*, and then, after a little more climbing, arrived at our destination. The rock derives its name from a drawing of Napoleon III. on horseback, with dogs, and women offering flowers to soldiers. Underneath is written "Ti Napoleon torna i la tua Francia e lasia il Piemonte, Guiseppe Lanterio di Tenda, 1849," and "li 30 Agosto 1849 Anno della Republica e di libertà." Although this is only scratched in fine lines on the rock, it is, after more than sixty years, quite distinct and legible. On the same rock there is an excellent figure of a man and two oxen with a plough, and of this, with one or two smaller figures, we took rubbings. There is also a curious figure, probably a plan, resembling Pl. I. fig. 2, which accompanies this paper, but different in shape. Leaving this extremely interesting rock we continued our climb to the top of the ridge, where there is more vegetation than on the rocky slopes, and here there were several good plants which we were glad to gather. We then descended by another route, very precipitous, but the rocks being broken up into natural steps and terraces there was no difficulty in following our excellent guide, and in reaching the comparatively level ground of the valley, and at length the Casa Fontanalba. Thus ended an ever to be remembered excursion, memorable alike for grand scenery, the glimpse into prehistoric times, and the rare plants which we collected.

On the accompanying plates I give a few examples of the different types of figures, copied from Mr. Bicknell's book.

Pl. I. f. 4 shews an ox with horns, ears, and tail, but without legs. The reason that the animals were almost always drawn in this way is probably that they were represented as seen from the steep hill-side, when they were at work or feeding in the valleys below. From this point of view little of the legs would be seen. Pl. I. f. 8 is a good figure of a man driving two oxen with a

plough, and a boy in attendance, and f. 12 two oxen drawing a harrow or hurdle. Pl. II. f. 2 looks like a scorpion, but having only four legs it is more likely that it is intended for an ox. Mr. Bicknell is of opinion that almost all the figures of animals are meant to represent oxen. Pl. II. f. 5 appears to be an ox with very long horns, four legs, ears as long as the legs, and no tail. Pl. II. f. 15 might be puzzling if it stood alone, but compared with others more complete, it will be seen to be an unequal pair of oxen with a plough. The very long wavy horns are an instance of the way in which some of these old sculptors gave play to their imagination in their designs. This is still more strikingly shewn in Pl. I. f. 11, where the entire figure is four feet eight inches long, and the horns are three times as long as the body of the animal. Some of the heads are drawn with two pairs of horns, either similar or very different in size and shape.

Figures of men are rare in the Meraviglie, but a good many are known in Val Fontanalba. The man and boy in Pl. I. f. 8 have already been mentioned. Pl. II. f. 1 is a small figure, about $9\frac{1}{2}$ inches high, holding aloft an implement with a long handle. In one, out of several given by Mr. Bicknell, the handle of the implement is nine times the height of the man. Pl. II. f. 7 is a figure nearly seven inches long of a solitary man, and f. 12 is a diminutive figure of a man with an enormous weapon.

Weapons are well represented on the Meraviglie rocks, and are also found, but less commonly, in Val Fontanalba. Pl. I. f. 3 is similar to one which is said to be a fair representation of a halberd of the Bronze Age. At the back of the head there is a clear space with dots, which may be nails, or simply ornamentation. Pl. I. f. 5 appears to be a dagger about 13 inches long, with guards. In several of the figures, as in this one, there is a clear space or band at a greater or less distance from the base of the weapon. Pl. I. f. 7 is about 7 inches long, and is apparently a small dagger, while figs. 9, 10, and 13, of Pl. I. may be axes or hammers, and Pl. II. f. 9 an arrowhead. Pl. II. f. 8 may be the supposed Labarum or Roman Ensign, mentioned by Geofreddo. Pl. I. f. 6 is perhaps some agricultural implement, but what it is difficult to say. A unique figure of a spiral is shewn in Pl. II. f. 3. The partitions closing some of the internal spaces suggest the idea of a labyrinth. Pl. II. f. 14, a rectangle with loops, is possibly the ornamented skin of an animal, or simply a geometrical figure cut at the fancy of the sculptor. Other figures, of which it is difficult to find an explanation, are Pl. II. f. 6, a circle with cross bars, which appears to stand on five feet, and Pl. II. f. 10, perhaps the most curious of all. Mr. Bicknell describes it as the blades of two weapons turned away from each other, with their handles connected by cross bars and a rectangle at the base. At the back of each blade there is what appears to be a hand with outstretched fingers. Mr. Moggridge figured the upper part of this, but the base was hidden until Mr. Bicknell dug it out. Of the other figures on this plate little can be said.

Mr. Bicknell gives several examples of a type of figure similar to that on Pl. I. f. 2, one of which is cut on the Napoleon Rock. The most feasible explanation of these is that they are plans of buildings and enclosures, the buildings being indicated by the rectangles, which are sculptured all over. There are also lines which may represent paths leading to the buildings, and the oblong markings in one of the enclosures may be intended for cattle, and the dots in the other for sheep, as similar markings are found in some of the other plans.

That the engravings are of considerable antiquity there can be little doubt, and one cannot but think that the study and comparison of the implements and weapons with actual specimens of those of past ages, may some day enable archæologists to fix their age, at least approximately, and to give some more definite information of the people by whom the figures were executed. M. Molon, referring to the figures given on M. Clugnet's plates, is of opinion that they probably date from between the Stone and Bronze Ages ; Mr. Bicknell believes that the Meraviglie figures were executed by a different tribe and at a different epoch from those in Val Fontanalba ; M. Rivière thinks that the sculptors were of Libyan origin, and says that some of the rock figures in Morocco are similar and cut in the same way by repeated blows ; Prof. Lissauer, of Berlin, attributes them to the Iberian branch of the Mediterranean family, and Prof. Celesia to the Phœnicians.

Mr. Bicknell, than whom no one is better qualified to speak with authority, gives his reasons for considering that the figures are of great antiquity, and also for the conclusion at which he has arrived as to the object and purpose of the rock engravings. The latter I give in his own words :

"We . . . consider these innumerable rock engravings to have been a sort of votive offering, reminders to unseen powers, good or malignant, of the people's needs or fears ; the expression of their desires for the well-being of their beasts, the safety of their settlements, the increase of their property, and general prosperity and good luck in agriculture or in hunting. These enduring prayers in stone would have been a witness not only for a moment but for ages to come. With this explanation we think we understand the rock figures better, and we can fancy the people doing more with the hope of getting more."

For full information on this fascinating subject the reader is referred to Mr Bicknell's own work, where he will find described in detail all that I have merely given in outline, and his directions to travellers will be of the greatest service to any who may have the intention to explore this region of " Wonders " for themselves.

EXPLANATION OF FIGURES.

PLATE I.

- FIG. 1.—Skin of an animal.
,, 2.—Plan of buildings and enclosures.
,, 3.—Weapon (like halberd of Bronze Age).
,, 4.—Ox, with horns, ears, and tail.
,, 5.—Apparently a dagger.
,, 6.—Perhaps an agricultural implement.
,, 7.—Apparently a dagger.
,, 8.—Man driving two oxen with plough, and a boy in attendance.
,, 9.—Axe or hammer.
,, 10.—Axe or hammer.
,, 11.—Ox with very long horns.
,, 12.—Two oxen drawing harrow or hurdle.
,, 13.—Axe or hammer.

PLATE II.

- FIG. 1.—Man holding aloft an implement.
,, 2.—Scorpion, or more likely an ox.
,, 3.—Unique figure of a spiral.
,, 4.—Skin of an animal.
,, 5.—Ox, with long horns, four legs, no tail, and ears as long as legs.
,, 6.—Circle with cross bars, and five feet.
,, 7.—Solitary figure of a man.
,, 8.—Supposed Labarum or Roman ensign.
,, 9.—Arrowhead.
,, 10.—Blades of two weapons, the handles connected by crossbars.
,, 11.—Animal or skin (?)
,, 12.—Diminutive figure of a man with an enormous weapon.
,, 13.—Wheel (?), with spokes and crossbar.
,, 14.—Possibly ornamented skin of animal.
,, 15.—Unequal pair of oxen with a plough.
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List of Publications bearing on the Geology of the Bristol District for the years 1875 to 1895.

THE following list forms a continuation of that published in 1876, in Mr. H. B. Woodward's *Geology of East Somerset and the Bristol Coalfields*. The area included is the same in the two cases. The list has been prepared, under the superintendence of Prof. S. H. Reynolds, in the Geological Department of the University of Bristol, by Mr. J. E. Livingstone.

1875.

ANON, 'Handbook to the Local Museum formed by the aid of the Bristol Naturalists Society.' Bristol.

ANON, 'The Inverted Strata of the Mendips' (letter). *Geol. Mag.*, new ser., Dec. 2, Vol. II, pp. 566-568.

CRUTWELL, A. C. 'The Great Rhaetic Bone Bed near Frome.' *Ibid.* p. 96.

First Report of the Committee for Investigating the Underground Waters in the New Red Sandstone and Permian Formations, etc. *Rep. Brit. Ass.*, (Bristol) pp. 132-134.

GRENFELL, J. G. 'Notes on Carboniferous Encrinites from Clifton and from Lancashire.' *Rep. Brit. Ass.*, (Bristol). Trans. of Sections, pp. 65-66.

HERIOT, MACKAY. 'Analysis of the Bath Mineral Waters.' *Proc. Bath Nat. Hist. and Antiq. Field Club*, Vol. III., No. 2, p. 170.

HERIOT, MACKAY. 'The Mineral Spring at Batheaston.' *Ibid.* pp. 171-177.

HOWARD, THOMAS. 'On the River Avon (Bristol) ; its Drainage Area, Tidal Phenomena and Dock Works.' *Rep. Brit. Ass.* (Bristol), pp. 175-184.

MARTYN, S. 'On Fish Remains in the Bristol Old Red Sandstone.' *Proc. Bristol Nat. Soc.*, Vol. I, new ser., pp. 141-144.

McMURTRIE, J. 'Notes on the Physical Geology of the Carboniferous Strata of Somersetshire and Associated Formations.' *Proc. Somerset Arch. and Nat. Hist. Soc.*, Vol. XXI, pt. 2, pp. 41-52.

McMURTRIE, J. 'On certain Isolated Areas of Mountain Limestone at Luckington and Vobster.' *Rep. Brit. Ass. (Bristol)*, Trans. of Sections, pp. 76-77.

MOORE, C. 'On the Age of the Durdham Down deposit yielding *Thecodontosaurus*, etc.' *Ibid.* pp. 77-78.

MORRIS, J. 'On the Occurrence of Boring Mollusca in the Oolitic Rocks.' *Geol. Mag.*, new ser., Dec. 2, Vol. II, pp. 267-272.

- SANDERS, W. 'On Certain large Bones in Rhaetic Beds at Aust Cliff, near Bristol.' *Rep. Brit. Ass. (Bristol)*, Trans. of Sections, pp. 80-81.
- STODDART, W. W. 'Geology of the Bristol Coalfield.' Pt. 2, 'Silurian and Devonian' *Proc. Bristol Nat. Soc.*, Vol. I, new ser., pp. 262-272.
- STODDART, W. W. 'On Auriferous Limestone at Walton.' *Rep. Brit. Ass. (Bristol)*, Trans. of Sections, p. 81.
- TATE, R. '*Sphenonchus hamatus*, a Rhaetic fossil (from Aust).' *Geol. Mag.*, new ser., Dec. 2, Vol. II, p. 286.
- TATE, R. 'The Lias about Radstock.' *Q.J.G.S.*, Vol. XXXI, pp. 493-509.
- TAWNEY, E. B. 'Notes on the Lias in the neighbourhood of Radstock.' *Proc. Bristol Nat. Soc.*, Vol. I, new ser., pp. 167-189.
- TAWNEY, E. B. 'Notes on Trias Dykes.' *Ibid.* pp. 162-166.
- TAWNEY, E. B. 'On the Age of the Cannington Park Limestone and its relation to Coal Measures south of the Mendips.' *Rep. Brit. Ass. (Bristol)*, Trans. of Sections, p. 82.
- TAWNEY, E. B. ; W. W. STODDART AND R. TATE. 'Bristol and its Environs. Historical, Descriptive and Scientific.' *Published by the Local Executive of the British Association (Bristol)*.
- USSHER, W. A. E. 'On the sub-divisions of the Triassic Rocks between the Coast of West Somerset and the South Coast of Devon.' *Geol. Mag.*, new ser., Dec. 2, Vol. II, pp. 163-168.
- WALDRON, C. 'Roman Mining on the Mendip Hills.' *Trans. Cardiff Nat. Soc.*, Vol. VII, pp. 1-5.
- WINWOOD, H. H. 'Notes on some Railway Sections near Bath.' *Proc. Bath Nat. Hist. and Antiq. Field Club*, Vol. III, No. 2, pp. 129-135.
- WINWOOD, H. H. 'Notes on the Geology of Clevedon.' Summary of Proceedings. *Ibid.* pp. 193-197.
- WITCHELL, E. 'Observations upon a Bed of Fuller's Earth at Whiteshill near Stroud.' *Proc. Cotteswold Nat. Field Club*, Vol. VI, pp. 144-145.
- WOODWARD, H. B. 'Notes and Problems for Somerset Geologists.' *Proc. Bath Nat. Hist. and Antiq. Field Club*, Vol. III, No. 2, pp. 177-182.
- WRIGHT, T. 'Note on the Reptilian Remains from the Dolomitic Conglomerate on Durdham Down.' *Rep. Brit. Ass. (Bristol)*, Trans. of Sections, p. 85.
- WRIGHT, T. Presidential Address to Geological Section. *Ibid.*, pp. 47-62.

1876.

- BATTEN, E. C. 'The Cause of the Heat of the Bath Waters.' *Proc. Somerset Arch. and Nat. Hist. Soc.*, Vol. XXII, pt. 2, pp. 52-60.
- Excursion to Burrington Coombe, Charterhouse Mines and Cheddar Cliffs. Summary of Proceedings, *Proc. Bath Nat. Hist. and Antiq. Field Club*, Vol. III, No. 3, pp. 350-352.
- GRENFELL, J. G. 'Carboniferous Encrinites from Clifton and Lancashire.' *Proc. Bristol Nat. Soc.*, new ser., Vol. I, pp. 476-488.
- HERIT, M. 'The Mineral Waters of Bath.' *Proc. Somerset Arch. and Nat. Hist. Soc.*, Vol. XXII, pt. 2, pp. 47-51.
- McMURTRIE, J. 'On Certain Isolated Areas of Mountain Limestone at Luckington and Vobster in the County of Somerset.' *Proc. Bath Nat. Hist. and Antiq. Field Club*, Vol. III, No. 3, pp. 287-300.
- MOORE, C. 'The Geology of Bath.' The Original Bath Guide, new ed., (not verified).
- MOORE, C. 'The Liassic and other Secondary Deposits of the Southerndown Series (Glamorganshire).' *Trans. Cardiff Nat. Soc.*, Vol. VIII, pp. 53-60.
- PERCEVAL, S. G. 'On the Discovery of *Palaeacis cuneata*, Meek and Worthen, in Carboniferous Limestone near Henbury, Bristol.' *Geol. Mag.*, new ser., Dec. 2, Vol. III, pp. 267-268.
- READE, T. M. 'The Lower Lias of Street, Somerset.' *Proc. Liverpool Geol. Soc.*, Vol. III, pt. 2, pp. 97-99.
- STODDART, W. W. 'Geology of the Bristol Coalfield.' Pt. 3, Carboniferous. *Proc. Bristol Nat. Soc.*, new ser., Vol. I, pp. 313-334; and Pt. 4, Coal Measures. *Ibid.* pp. 335-350.
- TAWNEY, E. B. 'On the Age of the Cannington Park Limestone and its Relation to the Coal Measures South of the Mendips.' *Ibid.* pp. 380-387.
- USSHER, W. A. E. 'On the Triassic Rocks of Somerset and Devon.' *Q.J.G.S.*, Vol. XXXII, 367-394.
- WINWOOD, H. H. 'Notes on a Rhaetic and Lower Lias Section on the Bath and Evercreech Line near Chilcompton.' *Proc. Bath Nat. Hist. and Antiq. Field Club*, Vol. III, No. 3, pp. 300-304.
- WOODWARD, H. B. 'Additional Remarks upon Inversions of Carboniferous Strata in Somersetshire.' *Geol. Mag.*, new ser., Dec. 2, Vol. III, pp. 455-458.
- WOODWARD, H. B. 'Geology of East Somerset and the Bristol Coalfield.' *Mem. Geol. Surv.*

1877.

- BLAKE, J. F. AND W. H. HUDLESTON. 'On the Corallian Rocks of England.' *Q.J.G.S.*, Vol. XXXIII, pp. 260-405.
- BUCKMAN, J. 'The Cephalopoda-Beds of Gloucester, Dorset and Somerset.' *Ibid.* pp. 1-9.
- EVANS, F. G. 'The Cheddar Caves.' *Trans. Cardiff Nat. Soc.*, Vol. IX, pp. 67-72.
- GUISE, SIR W. V. Address to the Cotteswold Nat. Field Club. Notes on Dundry. *Proc. Cotteswold Nat. Field Club.*, Vol. VI, pp. 293-296.
- JACKSON, M. Visitor's Handbook to Weston-super-Mare and its Vicinity. *Weston-s.-Mare and London.*
- MOORE, C. 'The Banwell Bone Cave.' *Trans. Cardiff Nat. Soc.*, Vol. IX, pp. 64-66.
- SMITHE, F. 'On the Middle Lias of North Gloucestershire.' 'The Spinatus Zone.' *Proc. Cotteswold Nat. Field Club*, Vol. VI, pp. 349-405.
- STODDART, W. W. 'A Deep Section in Old Market Street.' *Proc. Bristol Nat. Soc.*, new ser., Vol. II, pp. 77-78.
- STODDART, W. W. 'Fossil Microzoa of Clifton and the Neighbourhood.' *Monthly Micro. Journ.*, Vol. XVIII, p. 264.
- STODDART, W. W. 'Geology of the Bristol Coalfield.' Pt. 5, Triassic. *Proc. Bristol Nat. Soc.*, Vol. II, new ser., pp. 39-47; and *ibid.* pt. 6, Rhaetic, pp. 48-55.
- STODDART, W. W. 'List of the Characteristic Fossils of the Dundry (Inferior) Oolite.' *Proc. Cotteswold Nat. Field Club.*, Vol. VI, pp. 297-300.
- STODDART, W. W. 'Notes on the Metals found near Bristol.' *Proc. Bristol Nat. Soc.*, Vol. II, new ser., pp. 68-76.
- WOODHOUSE, T. 'Some Notes on the Geology of Otterhampton.' *Proc. Somerset Arch. and Nat. Hist. Soc.*, Vol. XXIII, pt. 2, pp. 65-69.
- WRIGHT, T. 'On the Geological and Palaeontological Characters of the Country round Bristol.' *Coll. Guardian.* Vol. XXXIII, pp. 601, 602, 641, 642. (reference not verified.)

1878.

- HIPPISLEY, H. E. 'Somersetshire Coal Measures.' *Geol. Mag.*, new ser., Dec. 2, Vol. V, pp. 345-350.
- RAMSAY, A. C. 'Physical Geology and Geography of Great Britain.' 5th ed., p. 511 et seq., London. (Discusses origin of Avon Gorge).
- STODDART, W. W. 'Singular Deposit of the Fossil Bones of the Water Vole.' *Proc. Bristol Nat. Soc.*, new ser., Vol. II, pp. 142-145.

- TAWNEY, E. B. 'On an Excavation at the Bristol Water Works Pumping Station, Clifton.' *Ibid.* pp. 179-182.
- TAWNEY, E. B. 'On the supposed Inferior Oolite at Branch Huish, Radstock.' *Ibid.* pp. 175-178.
- TOMES, R. F. 'On the Stratigraphical Position of the Corals of the Lias of the Midland and Western Counties of England and of South Wales.' *Q.J.G.S.*, Vol. XXXIV, pp. 179-195.
- USSHER, W. A. E. 'On the Chronological Value of the Triassic Strata of the South Western Counties.' *Ibid.* pp. 459-470.
- WALKER, J. F. 'On the Occurrence of *Terebratula morieri* in England.' *Geol. Mag.*, new ser., Dec. 2, Vol. V, pp. 552-556. Repeated *Proc. Dorset Field Club*, Vol. III, pp. 42-47.
- WETHERED, E. 'On the Fossil Flora of the Bristol Coalfield.' *Proc. Cotteswold Nat. Field Club*, Vol. VII, pp. 73-89.
- WINWOOD, H. H. 'Notes on an Oolitic Quarry at Bathford.' *Proc. Bath Nat. Hist. and Antiq. Field Club*, Vol. IV, No. 1, pp. 82-87.

1878—1886.

- WRIGHT, T. 'A Monograph of the Lias Ammonites.' *Palaeontograph. Soc.*

1879.

- BUCKMAN, J. 'On a Series of Sinistral Gasteropods from Somerset and Dorset.' *Proc. Dorset Nat. Hist. Field Club*, Vol. III, pp. 135-140.
- BUCKMAN, J. 'On the so-called Midford Sands.' *Q.J.G.S.*, Vol. XXXV, pp. 736-743.
- COLLIE, NORMAN. 'On the Celestine and Baryto-Celestine of Clifton.' *Proc. Bristol Nat. Soc.*, new ser., Vol. II, pp. 292-300.
- MOORE, C. Excursion to Bath. *Proc. Geol. Ass.*, Vol. VI, pp. 196-201.
- SORBY, H. C. Presidential Address to Geol. Soc., *Q.J.G.S.*, Vol. XXXV, pp. 83, 86-87, (describes minute structure of Carboniferous Limestone and other rocks of the Bristol district).
- STODDART, W. W. 'Geology of the Bristol Coalfield.' Pt. 5, Jurassic strata. *Proc. Bristol Nat. Soc.*, new ser., Vol. II, pp. 279-291,
- WINWOOD, H. H. with Notes by E. WITCHELL. Excursion to Haresfield Beacon. Summary of Proceedings, *Proc. Bath Nat. Hist. and Antiq. Field Club*, Vol. IV, No. 2, pp. 170-172.
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Production of air passages in the root of *Zea Mays* by variation of the culture media.

F. DE LA M. NORRIS.

INTRODUCTION.

THE following preliminary experiments were made in the Botany Department of the University of Bristol during the Session 1911-1912, in order to trace a connection between the development of, and modifications produced in, a plant by varying the conditions under which it is growing. The root of the plant is perhaps the part best adapted for experiments of this nature as it is comparatively an easy matter to alter the external conditions of the root without introducing into the experiment any factor which is likely to be detrimental to the general tone of the plant.

The plants (*Zea Mays*) were grown in several different soils and media, and in some cases they were germinated in damp sawdust and afterwards transferred to water cultures.

In many of the media the temperature was varied, some plants growing at a comparatively high temperature, others at a fairly normal one. It was found however on subsequent examination of the roots that this temperature variation produced no appreciable effect—except in the rate of growth of the plant.

EXPERIMENTS.

The following media were used in the various experiments :—

- (1) Potting soil.
- (2) Sand.
- (3) Damp sawdust.
- (4) Damp clay soil.
- (5) Wet ashy soil.
- (6) Ordinary soil.
- (7) Various water cultures.

NATURE OF THE MEDIA.

- (1) **POTTING SOIL.**—This consists of a mixture of fine soil, sand, and leaf-mould. It allows an easy access of air to the roots, and is also rich in food material.
- (2) **SAND.**—This medium allows the root a plentiful supply of air, and drains quickly. It is not however very well supplied with nutritive substances.
- (3) **DAMP SAWDUST.**—This is not a very favourable medium—both food material and air being scanty.
- (4) **DAMP CLAY SOIL.**—This soil drains very badly, and does not allow much access of air to the roots; it is not a favourable medium to derive the necessary food substances from.
- (5) **WET ASHY SOIL.**—This is also very poor in food material; the air has fairly free access to the roots.

- (6) **ORDINARY SOIL.**—This is a favourable soil, but is slightly inferior, as regards aeration, to the potting soil.
- (7) **VARIOUS WATER CULTURES.**—The media were boiled, and then there was very little air obtainable by the roots; the food supply was good, all the necessary salts being present.

VARIATIONS IN THE STRUCTURE OF THE ROOTS.

- (1) **Taking those roots developed in POTTING SOIL as a normal type,** we find externally no feature of any marked interest. The roots at the stage examined were the usual type of slender cylindrical ones, possessing a fairly plentiful supply of root hairs.

Internally, the central cylinder is of the usual type, and shows nothing abnormal in its development. Surrounding this central cylinder there is a cortex about six layers of cells in thickness. It is in this layer that the greatest variation occurs.

All through the series of roots there was a distinct tendency either to form or suppress the air-spaces, and these air-spaces seemed to show a relation to the external conditions. In the case of the potting soil these air-spaces were but scantily developed. The younger and central portions of the root were free from them, and it was only in the upper portions that they were found to occur, and even here they were not always present.

In every case a number of sections were made in the various portions of several roots, and the results obtained based on the general distribution and the general occurrence of these air-spaces.

- (2) **SAND.**—These roots were of the general type; they were if anything inclined to be rather swollen in appearance. The central cylinder was well developed. The cortex seemed absolutely free from air-spaces; none of the sections from the upper, middle, or lower portions showing any trace of them. This was the only condition under which the plant was absolutely free from them. Fig. 1 is a drawing of a typical section of the upper portion of a root grown in sand.
- (3) **DAMP SAWDUST.**—The development of root hairs was very scanty, most roots being practically without them.

The central cylinder is well developed, more so than in the potting soil.

The air-spaces occur throughout the roots; they appear to be formed by the breaking down of groups of cells, the cell walls in many cases are not completely broken and stretch across the air-spaces.

Fig. 2 is a drawing of a typical section.

- (4) **DAMP CLAY SOIL.**—There was a fairly plentiful development of root hairs; the central cylinder was also well developed. The air-spaces were generally conspicuous throughout the roots, appearing in both the older and younger portions. They formed a fairly regular system round the central

cylinder, and were roughly circular in section. They occupied a central position in the cortex.

Fig. 3 is from a section of a root grown in this medium.

- (5) **WET ASHY SOIL.**—The roots were well developed and root hairs were present. The air-spaces were not constant in their occurrence, some roots being entirely without them. In others, however, there was a tendency to form them, and they were of the type found in potting soil. Many sections showed faintly defined groups of cells which rather seemed to point to the formation of air-spaces.
- (6) **ORDINARY SOIL.**—These roots were similar in nearly every respect to those developed in potting soil. The air-spaces were rather more frequent in their occurrence.
- (7) **WATER CULTURES.**—Several cultures were made in water and various food solutions. In all cases the roots were long and stringy, and were developed in considerable numbers. In all these roots the air-spaces were very characteristic throughout. They were not confined to the centre of the cortical tissues, but were narrow, and stretched nearly from the epidermal layer to the central cylinder.

There was a tendency for the central cylinder to become very compact.

Fig. 4 is a typical drawing of the structure occurring in roots from water cultures.

CONCLUSIONS.

From these experiments it would seem as if the plant made a definite and immediate response to the variations in the external conditions.

The development of air-spaces appears to depend largely upon the quantity of air available in the medium surrounding the root.

In those roots grown in sand—which retains little water and allows a fairly easy access of air—the air-spaces did not appear to be necessary, and we seem to be able to trace a fairly definite series throughout the different roots. Those growing in water show the most complete system of air-spaces. In this case the whole cortex is of a very flimsy and indefinite nature, and is very apt to fall all to pieces when an attempt is made to section the roots.

In other cases the cortex is more definite, and the air-spaces more regular in form and distribution. Further experiments with more definite methods of aeration of the medium will no doubt show a very close relation between these air-spaces in the roots and the quantity of available air surrounding them.

EXPLANATION OF FIGURES (PLATES III AND IV.)

- | | |
|---------|--------------------------------------|
| Fig. 1. | Root Section of plant grown in Sand. |
| Fig. 2. | “ “ “ “ Damp Sawdust. |
| Fig. 3. | “ “ “ “ Damp Clay Soil. |
| Fig. 4. | “ “ “ “ Water Culture. |

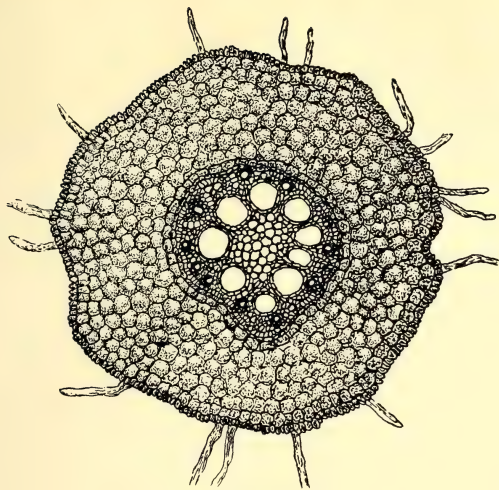


FIG. I.

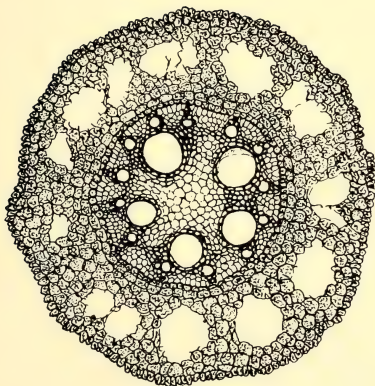


FIG. II.

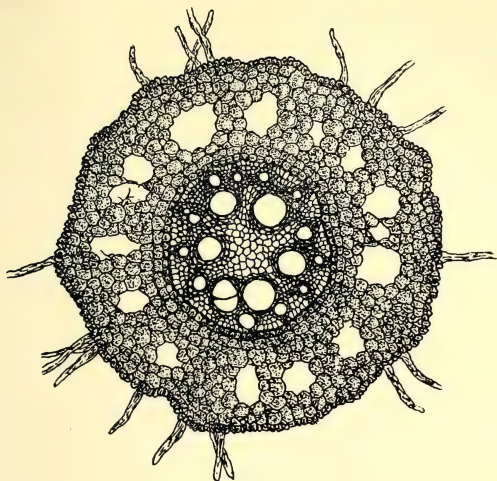


FIG. III.

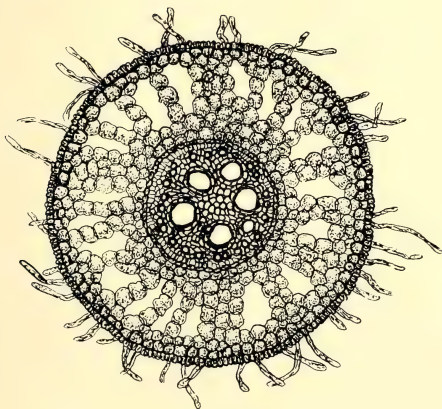
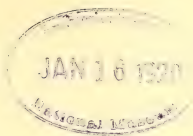


FIG. IV.



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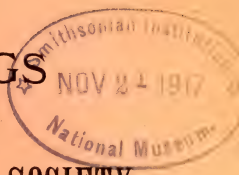
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P	Reynolds, S. H., M.A., Sc.D.	...	...	13 All Saints' Road, Clifton
A	Reynolds, Miss J. B.	...	...	4 Tottenham Place, Clifton
	Richardson, Frank	...	...	15 Percival Road, Clifton
	Robson, V. E.,	...	...	41a, Ravenswood Road, Redland
P	Roper, Miss I. M., F.L.S.	...	...	4 Woodfield Road, Redland
P	Rudge, C. K., L.R.C.P., M.R.C.S.	...	...	145 Whiteladies Road, Clifton
	Salter, Mrs.	...	...	187 Coldharbour Road, Redland
	Sandwith, Mrs.	...	...	26 Canynge Square, Bristol
	Savory, J. H.	...	...	Rodney Place, Clifton
	Scott, W. G.	...	...	25 Duke Street, Cardiff
	Seyler, C. A.	...	...	Nelson Terrace, Swansea
	Shaw, Dr. J. E.	...	...	23 Caledonia Place, Clifton
	Shepherd, G. D.	...	...	Gresham Chambers, Kingsway, Cardiff
A	Sinnott, Jas.	...	...	15 Beaufort Road, Clifton
A	Smallcombe, W. A.	...	...	62 Greenbank Road, Easton, Bristol
A	Smith, Miss A. M.	...	...	70 Pembroke Road, Clifton
A	Smith, Miss E. J.	...	...	70 Pembroke Road, Clifton
P	Smith, G. Munro, M.R.C.S.,	...	...	18 Apsley Road, Clifton
	L.R.C.P.	...	...	
	Smith, H. C.	...	...	13 Acraman's Road, Southville, Bristol
	Smith, W. A., M.B.	...	...	70 Pembroke Road, Clifton
	Stanton, D. W.	...	...	The Ferns, 42 Alma Road, Clifton
	Stanton, Mrs.	...	...	The Ferns, 42 Alma Road, Clifton
	Stephens, A., M.I.E.E.	...	...	The Firs, Easton-in-Gordano
	Stewart, D. McDonald, F.G.S.	...	...	25 Woodstock Road, Bristol
	Stoddart, F. W., F.I.C., F.C.S.	...	...	Grafton Lodge, Sneyd Park, Bristol
L	Strickland, Thompson	...	...	13 Victoria Square, Clifton
A	Sturge, Francis	...	...	11 Leigh Road, Clifton
P	Tutcher, J. W.	...	...	57 Berkeley Road, Bishopston, Bristol
	Underhill, J.	...	...	2 Brynland Avenue, Bishopston, Bristol
P	Vaughan, A., B.A., D.Sc., F.G.S.	...	...	University Museum, Oxford
	Vaughan, P. H.	...	...	Redland Hill House, Bristol
A	Wadlow, H. J.	...	...	School House, Frenchay
	Walker, Edwin	...	...	9 Tyndall's Park Road, Bristol
	Walton, J. C. H.	...	...	18 West Park, Bristol
	Waterfall, W. B.	...	...	64 Woodstock Road, Bristol
	Webb, R. B.	...	...	Parkdale, 20 Belgrave Rd., Tyndall's Park, Bristol
A	Wells, A. E.	...	...	38 Henleaze Gardens, Westbury-on- Trym
P	White, Jas. W., F.L.S.	...	...	18 Woodland Road, Clifton, Bristol
	White, Mrs.	...	...	18 Woodland Road, Clifton, Bristol
P	Wickes, W. H.	...	...	7 St. John's Road, Clifton
	Williams, Miss K. I., B.Sc.	...	...	Llandaff House, 1 Pembroke Vale, Clifton, Bristol
A	Williams, Miss R. L.	...	...	12 Henleaze Gardens, Durdham Down, Westbury-on-Trym
	Winwood, Rev. H. H.	...	...	11 Cavendish Crescent, Bath
A	Winn, Miss	...	...	10 Priory Road, Bristol
A	Wood, Miss K. M.	...	...	8 Westbury Park
A	Woodey, E. L.	...	...	Hildrop, South Road, Kingswood, Bristol
	Worsley, P. J., B.A., F.C.S.	...	...	Rodney Lodge, Clifton
	Worsley, Miss I.	...	...	Rodney Lodge, Clifton
A	Wright, Miss A. H. M.	...	...	4 Buckingham Place, Clifton
	Yabbicom, T. H., M.I.C.E.	...	...	23 Oakfield Road, Clifton

REPORT OF THE COUNCIL

To December 30th, 1913.

DURING the last year there has been a nett increase of membership of 28.

		Ord. Members.	Associate Members.	Total.
1912	...	85	39	— 124
1913	...	103	49	— 152
Increase	...	18	10	— 28

In addition there are 13 Hon. Members, and also 11 Student Members who are Members of Sections only, making a grand total of 176.

During the year the Proceedings for 1912 were published, representing Series IV, Vol. III, Part IV, of the Proceedings, and extending over 48 pages. The Proceedings now bear the title "Annual Report and Proceedings of the Bristol Naturalists' Society."

The last year, 1913, was taken as the Jubilee Year owing to the Annual Meeting in January being the 50th of its kind. The Society was actually founded in 1862.

The following Meetings were held during the year :—

Jan. 16th, 1913.—Annual meeting (50th Anniversary). Presidential Address by Dr. G. Munro Smith, entitled : "The Point of View."

Feb. 6th.—Miss Williams : "Fish and Vegetable Foods as served at Table."

Mar. 6th.—Dr. Rudge : "The Food of Animals and Stratagems Employed in Obtaining It."

April 3rd.—Mr. C. Bucknall : "On Some Pre-historic Rock Figures in the Maritime Alps."

May 1st.—Mr. D. M. Smith : "Notes on Birds."

„ 8th.—Jubilee Reception by the Lord Mayor of Members of the Society at the Natural History Museum.

June 14th.—Jubilee Excursion to Wrington and Barley Woods.

Oct. 2nd.—Mr. W. A. Smallcombe : "Observations on Ants."

Nov. 6th.—Jubilee Exhibition Meeting. About 50 Exhibits illustrating mainly the Fauna, Flora and Geology of the Bristol District."

Dec. 4th.—Dr. W. E. Hoyle, "Folk Museums."

There was an average attendance of about 40 Members and friends at each meeting, but this figure does not include the Jubilee Reception at the Museum or the Jubilee Exhibition Meeting, at which 250 Members and friends were present.

LIBRARIANS' REPORT.

For the Year 1913.

DURING the twelve months only fourteen members have taken books out of the Library, and the number of books borrowed has been eighty-three. Of these, sixteen were still out at the end of the year, and thirteen, which were taken in 1912, have not been returned.

Thirty-three volumes have been bound, at a cost of 2s. 4d. each.

We have received during the year from the Corresponding Societies, ten bound volumes, and 252 unbound parts of current publications. To the following donors of books we offer our sincere thanks:—

BRITISH ASSOCIATION, for the 82nd Report (Dundee), 1912.

PROF. SYDNEY YOUNG, F.R.S., for "*Philosophical Transactions of the Royal Society*," Series B, Vol. 203, 1913.

DR. A. B. PROWSE, for the 4th Report of Botanical Committee of the Devonshire Association, 1912.

F. F. TUCKETT, ESQ. (THE LATE) for the 82nd Report of British Association, 1912.

JANET, MONS. CHARLES, for one *Biological* and one *Botanical* paper.

The following periodical has been received from the ENTOMOLOGICAL SECTION, B.N.S.:—*Entomologist*, No. 580 of Vol. 44 (Sept., 1911).

We have received the following Subscription Volumes and parts:—

From the RAY SOCIETY:—*British Parasitic Copepoda*, Vol. I. (Scott), for 1912. *Bibliography of the Tunicata* (1469-1910) (Hopkinson), for 1912. *British Parasitic Copepoda*, Vol. II. (Scott), for 1913.

There is no alteration in the Exchange List.

ARTHUR B. PROWSE, M.D., *Hon. Librarian.*

IDA M. ROPER, *Hon. Sub-Librarian.*

Jan. 22nd, 1914.

EXCHANGE LIST.

Ashmolean Natural History Society of Oxfordshire
 Barrow Naturalists' Field Club
 Bath Natural History and Antiquarian Field Club
 Belfast Naturalists' Field Club
 Birmingham Natural History and Philosophical Society
 Bristol Corporation Public Libraries (Subscription)
 Bristol Museum and Art Gallery
 British Association
 British Museum (Natural History), S.W.
 Cardiff Naturalists' Society
 Chester Natural Science Society
 Clifton Antiquarian Club
 Clifton College Scientific Society
 Cornwall, Royal Geological Society of
 ———, Royal Institution of
 ———, Royal Polytechnic Society
 Cotteswold Naturalists' Field Club
 Ealing Scientific and Microscopical Society
 Edinburgh Geographical Society
 ——— Royal Botanic Society
 Essex Field Club
 Geological Society of London
 Geologists' Association
 Glasgow Geological Society
 ——— Natural History Society
 ——— Philosophical Society
 Hertfordshire Natural History Society and Field Club.
 Liverpool Geological Association
 ——— Geological Society
 ——— Literary and Philosophical Society
 ——— Science Students' Association
 Manchester Literary and Philosophical Society
 ——— Microscopical Society
 ——— Museum Library
 Marlborough College Natural History Society
 North Staffordshire Field Club
 Norfolk and Norwich Naturalists' Society
 Nottingham Naturalists' Society
 Plymouth, Marine Biological Association of the United Kingdom
 ——— Institution and Devon and Cornwall Natural History Society
 Quekett Microscopical Club
 Royal Irish Academy
 Royal Microscopical Society
 Rugby School Natural History Society
 Somersetshire Archæological and Natural History Society
 Torquay Natural History Society
 Woolhope Natural History Field Club
 Yorkshire Geological and Polytechnic Society
 ——— Naturalists' Union
 ——— Philosophical Society

Our "Proceedings" are sent as a free gift to :—

British Museum Library
 Cambridge University Library
 Dublin, Trinity College Library
 Edinburgh, Advocates' Library
 Oxford, Bodleian Library
 Patent Office Library, London

AUSTRIA.

Wien, K. K. Naturhistorisches Hofmuseum

FRANCE.

Lyon, La Société Linnéenne de
University of Rennes

GERMANY.

Cassel, Verein für Naturkunde
Frankfurt a/O.—Naturwissenschaftlicher Verein für den Regierungs-
bezirk F. a/O
Giessen, Oberhessische Gesellschaft für Natur-und-Heilkunde
Halle a. Saale, Preussen, Kaiserliche Leopoldinische-Carolinische
Deutsche Akademie der Naturforscher
Hamburg, Verin für Naturwissenschaftliche Unterhaltung

NORWAY.

Det Kongelige Norsk Universitet i Christiania

SWITZERLAND.

Société Vandois des Sciences Naturelles, Lausanne
Zürich, Naturforschende Gesellschaft in Zürich

AUSTRALIA.

Australasian Association for the Advancement of Science
New South Wales, Geological Survey
_____, Royal Society of
Queensland Museum, Brisbane
Victoria, Royal Society of

CANADA.

Canadian Institute, Toronto
Hamilton Scientific Association
Nova Scotian Institute of Natural Science (Halifax)

INDIA.

Agricultural Journal of India
Agriculture, Imperial Department of
Geological Survey of India, Calcutta

MEXICO.

Mexico Sociedad Cientifica

UNITED STATES.

American Museum of Natural History, New York
Augustana College, Rock Island, Illinois
Boston (Mass.) Natural History Society
Brooklyn Institute of Arts and Sciences (Coldspring Harbour)
California, University of, (Berkeley)

Californian Academy of Sciences
 Cincinnati Natural History Society
 ——— Lloyd Library
 Colorado College (Colorado Springs)
 ——— University (Boulder)
 Connecticut Academy of Arts and Sciences (Yale University
 Publications)
 Denison Scientific Association, Ohio
 Essex Institute, Salem (Mass.)
 Illinois, University of, (Urbana)
 Indiana Academy of Science
 Michigan Academy of Science
 Missouri Botanical Gardens
 Missouri, St. Louis, Academy of Science
 New Mexico, University of, (Albuquerque)
 North Carolina (Chaple Hill) Elisha Mitchell Scientific Society
 Ohio State University (Columbus)
 Oklahoma State University
 Philadelphia Academy of Natural Sciences
 Philadelphia Wagner Free Institute of Sciences
 Smithsonian Institution, Washington
 Tufts' College (Mass.)
 United States Geological Survey of the Territories, Washington
 ——— Natural Museum, Washington

URUGUAY.

Montevideo, Museo Nacional de

ARTHUR B. PROWSE, M.D.,

January, 1914.

Hon. Librarian.

The HON. TREASURER in Account with the BRISTOL NATURALISTS' SOCIETY.

Dr.

GENERAL ACCOUNT FOR THE YEAR ENDING DECEMBER 31ST, 1913.

Cr.

	£	s.	d.		£	s.	d.
To Entrance Fees ..	..	4	5	0	By Fawn & Son—Stationery ..	..	..
" Subscriptions—Ordinary ..	..	33	5	0	" A. & J. Bolt—Bookbinding ..	..	..
" Do. Associate ..	..	8	5	0	" Fire Insurance ..	..	..
" Arrears Collected ..	..	4	0	0	" Rent of Reading Room, 1912	..	..
" Subscriptions paid in Advance ..	..	2	5	0	" Do. 1913 ..	..	..
" Donation to Reading Room ..	..	0	5	0	" T. & W. Goulding—Proceedings, &c., 1911	..	..
" Sale of Proceedings, &c. ..	..	1	6	8	" Do. do. 1912 ..	..	..
		£53	11	8	" J. Phillips & Sons—Bookcase ..	..	..
Total Receipts ..	..	48	3	8	" Henry Hill—Printing ..	..	..
To Balance in Bank, per last Account ..	..	4	8	1½	" University Marshall—Gratuity ..	..	..
" Cash in hands of Hon. Treasurer, per last Account ..	..	1	5	11	" Club Steward—Gratuity, 1912	..	..
" Do. ..	..	..	..	..	" Do. do. 1913 ..	..	..
		£57	11	9½	" Commons and Footpaths Preservation Society—Subscription	..	..
		£107	9	4½	" Zoological Society—Subscription ..	..	..
					" Ray Society—Subscription ..	..	..
					" Postages, &c.—Hon. Secretary ..	..	..
					" Do. Hon. Treasurer ..	..	..
					" Do. Hon. Librarian ..	..	..
					" Total Payments ..	£78	12 10½
					" Cash at Bank ..	24	1 2
					" Cash in Hand—Hon. Treasurer ..	2	12 0
					" Do. Hon. Librarian ..	2	3 4
						£107	9 4½

Audited and found correct,

ERNEST H. COOK,
CHAS. BARTLETT, A.C.A. } *Auditors.*

Bristol, January 21st, 1914.

GEOLOGICAL SECTION.

AT the end of the year there were 48 members which shows a slight increase on the former year, but a falling off from previous years.

Prof. S. H. Reynolds, M.A., F.G.S., was again elected President, and B. A. Baker, F.G.S., Secretary at the first Annual Meeting of the year.

There have been eight Meetings of the Section, when the following papers were read:—

January 23rd.—“Coral Reefs” (illustrated by lantern slides), by Miss G. M. Edwards.

February 20th.—“The Geology of the Water Supply of the Bristol District,” by H. F. Barke, F.I.C.

March 13th.—“The Geology of Australia” (illustrated by lantern slides), by G. E. Kirby.

May 22nd.—“Coal” (illustrated by lantern slides), by Miss W. E. Biggs.

October 23rd.—“Geology of the Caldbeck Fells, Keswick” (illustrated by lantern slides), by the President.

November 27th.—“Pneumatolysis,” by D. E. Innes, B.A.

December 27th.—Exhibition Meeting.

Several readers of the papers were students of the University, which showed the great advantage of the Bye-law admitting students from the University under special conditions. There was an average attendance of 16 members and friends.

The Financial Report shows a total receipt of £6 15s. 3d., and the expenditure £4 13s. 10d., including 17/9 brought forward from last year leaves a balance in hand of £2 1s. 5d. There are members whose subscriptions are in arrears.

B. A. BAKER, *Hon. Sec.*

ENTOMOLOGICAL SECTION.

FOUR Meetings and one excursion were held during the year as follows:—

January 3rd—Exhibits. Mr. Griffiths, Ova and specimens, in various stages of growth, of the stick insect *Bacillus* (*Rossea*?) from India. Mr. Charbonnier, a specimen of *Odynerus pictus* and its nest, which contained 10 lepidopterous larvæ and an hymenopterous larva, probably of *Chrysis ignita* which is parasitic on *Odynerus*.

April 9th—Exhibits. Mr. Griffiths showed a large section of his collection of lepidoptera, including specimens of *Polyomatus Dispar* recorded by Mr. Joseph Merrin as having been taken on the slopes of Doward Hill, bordering the River Wye, not far from Monmouth. *Zelotypia Stacyi*, *Drurya antimachus*, *Astacus Edwardsii*, &c.

May 31st—Excursion to Dursley. A very wet stormy day, but the following species were taken. *Inogeryon*, *Euclidia mi*, *E. glyphica*, *Phytometha ænea*, *Eupithecia lariciata*, *Nudaria mundana*, *Pyrausta aurata*, *Thanaos tages*, and *Argynnis euphrosyne*.

November 4th—Mr. Charbonnier communicated a Paper on "Notes on a Collection of Humble Bees made during 1913 at Olveston." 9 species out of 15 of genus *Bombus*, and 3 out of 5 species of the parasitic genus *Psithyrus* were recorded. The species taken were on exhibition.

Mr. Hudd showed a box of species of lepidoptera taken in the Bristol District since his local list was issued by the Society in 1877, 109 extra species having been added.

Mr. Griffiths exhibited 13 species of *Chrysopidæ*, also a specimen of *Ascherontia Atropos* taken on the wall of Bristol Cathedral this year.

Hon. Secretary exhibited a box of Diptera, including two species new to the Somerset County list, viz., *Syrphus tricinctus* ♂ and *Helophylus hybridus*, both from Portishead, June 22nd, 1913. Also *Xanthogramma citrofasciatum*, Abbotsbury, and a ♂ *Sirex noctilio*, Portishead.

December 12th—Mr. Griffiths exhibited some specimens of *Epinephele-janira* taken by Mr. G. C. James on the Steep Holm, which appeared to have a greater development of the hind wing than normal British specimens.

Mr. Smallcombe showed some lepidoptera from Jersey, also five species of Ants, one of which was not British.

Hon. Sec. showed four drawers of life histories of British Lepidoptera.

CHARLES BARTLETT, *Hon. Sec.*

May 11th, 1914.

Members—

G. C. Griffiths, F.E.S., *President*.

Dr. C. King Rudge, L.R.C.P., M.R.C.S.

Col. Couchman.

Major Broughton.

H. J. Charbonnier.

W. A. Smallcombe.

Charles Bartlett, *Hon. Sec.*,

Rostock House, Woodhill, Portishead.

ANNUAL ADDRESS.

“SOME HISTORICAL ASSOCIATIONS OF FLOWERS.”

BY THE PRESIDENT—MISS I. M. ROPER, F.L.S.

THIS evening you have elected me to be the President of your Society for a second year, and I thank you for the honour you have done me in renewing your confidence.

There is another personal matter to which I wish to make reference. Twelve months ago, when you elected me, you are aware a great innovation was made by you in choosing a woman to be your President, and when you decided on this change, in face of the custom of 50 years and of some prejudice, you took a step for which I wish sincerely to thank you on behalf of my sex, even more than because I was the woman chosen.

I rejoice greatly that the honour of providing a President for the Jubilee year fell to Botany, but it is still more a source of gratification that it came to a woman botanist. Your generosity will, I hope, serve to encourage other women to take up the pursuit of Natural History in its different branches, and help to extend the usefulness of the Society.

The year 1913, as you know, has been an important one in the history of the Bristol Naturalists' Society, because it then completed the full 50 years of its existence. It was felt not only by the members themselves, but by all who took an interest in Natural History that such an event should be marked in some distinctive manner, to show that amidst the many calls which are made on the active minds of citizens in a large city, they are not forgetful of interests which may lead to advantages that we do not measure by monetary gains. They recognise that we live in a neighbourhood distinguished throughout the country for the richness of its natural beauties, amidst which studies can be continually carried on in all the branches of Natural Science, or at least observations can easily be made to enliven our spare hours and keep us in touch with many interesting events in the changing seasons.

As might be expected under such circumstances, a number of amateurs pursue their hobbies in touch with others having the same interests, and although this fellowship may cause the splitting up into a greater number of small societies than may be good, we have yet seen that when the occasion arises these smaller bodies are ready to unite to celebrate the success of a long established Society like the Bristol Naturalists', and to encourage its members by kindly congratulation to continue their work with renewed zeal.

It was such feelings as these that prompted the Lord Mayor of Bristol and the Committee of the Museum and Art Gallery to gather together, amidst the splendid collection of natural objects,

all those who had kindred interests, and the members of this Society will have felt proud that their good work was thus recognised and such high honour paid to them. About 400 invitations were accepted to that gathering, held on May 8th, the day that saw the 50 years of the Society's existence brought to a completion, and the neighbouring societies of the Cotteswold Field Club, and the Cardiff Naturalists' Society sent their chief representatives with messages of congratulation and encouragement, whilst numerous former members, who have risen to high rank in the world of Science, wrote their gratification at the vigorous scientific life we are still maintaining.

After a pleasant Jubilee excursion into the country in the summer, the University of Bristol was not behindhand in offering us encouragement, and it is fresh in your memory the kindness of the authorities in giving us the use of the Great Hall, to enable the members to hold a large exhibition of Natural History objects whereby they could see and compare notes of the long continued and persistent accumulation of varied collections.

We must feel gratified with the success of our Jubilee celebrations, and I believe it will long remain in the memories of those who took part. We can start the New Year with the knowledge of our aims spread amongst a greater number of people, and can expect to gain new recruits, of which we have already had signs, to carry on the work.

You do not want me to dwell longer on the events connected with the Society, because its history has been ably written about by a past President, but I should like to take the opportunity to speak on "Some Historical Associations of Flowers," that may tend to give more than a passing interest to some of our familiar plants, especially amongst those who are not already full of botanical lore.

From the earliest historic ages flowers have mingled with the deeds, and alas! misdeeds of man, and in all times they have been associated with the soldier, the government and the arts. Thus the patriot was crowned with Oak, the hero and the poet with Bay, and beauty with the Myrtle, whilst Peace had her Olive branch. But it is not of this aspect that I wish to speak. As a more scientific spirit has grown up in modern times it has been recognised that flowers are products of Nature, fashioned to take part in the struggle for existence and to adapt themselves to their surroundings, and much of the old romance attached to them has lost its interest.

On the other hand, however, the important events of history have become incorporated in the life of the nations, and the factors that have had a share in those events cannot be lightly put on one side. Amongst such factors certain flowers may have in the beginning played only a sentimental part, but in the course of centuries have served as a strong force in subsequent events. This is evident when we remember how, even of recent years,

the Primrose has given its name to the great League, which will for long be associated with the memory and principles of Lord Beaconsfield. It is the history of such plants as this that I wish to recall to your memory, and it may be of interest to you, if I briefly relate how some trivial incident in the past has led to their being singled out from the vast variety of flowers, and brought into greater prominence than their companions in the floral world.

The united countries of Great Britain have each their national emblem, and with one exception these emblems are chosen from well-known flowers of the garden or hedgerow, on account of their association with some of the most warlike events in the history of the nation.

The Rose, the queen of the floral world, comes first as the national emblem of England. That it was for a long period linked by the chain of association with kingly power and sovereignty seems certain, but its first connection in history with this country dates back to A.D. 1385 when John of Gaunt, Duke of Lancaster, "the time-honoured Lancaster" of Shakespeare, assumed a red rose as his cognizance, to be worn by himself, and to be given as a badge to his immediate personal followers. At the same time his brother, Edmund, Duke of York, assumed the white rose for similar purposes, and although then the flowers were but harmless emblems, they became to their descendants the opposing badges of two great rival Houses on many a fateful field of battle. Under their banners were fought the terrible Wars of the Roses, when the white rose of York was doomed to be dyed with the blood of thousands of its sons before the rival red rose of Lancaster gained possession of the Crown in the person of Henry VII., who adopted that flower as the national emblem.

It is, as you know, from this connection that the red rose is worn at the present day on April 23rd, the festival of St. George, the patron saint of England. By one of those strange coincidences that are noted in history, Dr. Linacre, physician to Henry VII., obtained from France a variety of the French rose, having on the same bush blossoms both red and white, with others striped. Popular fancy at once regarded it as significant of the union of the red and white roses, which had been in reality brought about by the marriage of the King with the Princess Elizabeth of York, the eldest daughter and heiress of Edward IV. Their son Henry VIII. in his dominant way regarded the rose as the true emblem of kingly power and adopted the two roses united in one as his well-known cognizance.

In remodelling the ancient Order of the Garter and endowing the King with the sole power of election, he added the Collar to the other insignia. This he formed of a red rose within a white one, alternating with a white one within a red; and the same combination of roses, carved in wood or stone is a marked feature in the ecclesiastical architecture of that period, and is known to us as the Tudor Rose.

It is to be regretted that the famous scene in the Temple Gardens, so picturesquely described by Shakespeare in his play of *Henry VI.*, must be regarded as a fanciful legend.

The red and white roses are not the only flowers that have stood in opposition, because the lily is another instance. This flower of different colours was adopted as a badge by rival factions, in the party wars of Italy, which occupy so large a share of the history of the 12th to the 14th centuries. While the Guelphs, the Pope's partisans, wore the red lily, the white lily was for the Ghibellines, or supporters of the Emperor, and here again the red triumphed.

The Scotch Thistle—said to be one of the most ancient badges on record—may next claim our attention. The thistle is suggestive of untidiness and neglect, and we are apt to regard it as a troublesome weed that is often a source of annoyance to the farmer. Looked at, however, in its association with Scotland, everyone thinks of it with respect, because of the noble deeds wrought under its influence, and because it seems a type of the hardy and vigorous life of the inhabitants. A thistle, however, likes to grow on deep, good soil, and here again, some may see in it a fitting sign for a people, who are said to cross the Border to take up rich places further South. There are fourteen species of native thistles, and although with so many to choose from, it must be confessed it is unknown from which of them the national badge has been adopted.

According to tradition the flower recalls the saving of the Scottish army in the 8th century from a surprise attack by the Danes, who, stealing silently under cover of night towards the slumbering camp, suddenly gave the alarm of their approach by one of them chancing to tread with unprotected feet on a thistle, whose sharp spines caused him to utter a loud cry of pain.

The details of this legend, however, will not bear historical investigation, and the reputed leaders of the opposing armies are known to have lived a century apart, so the true origin of the badge remains in the clouds. Its place in history is more modern. The first mention of the thistle as the national emblem occurs in a poem, "*The Thrissil and the Rose*,"* written in A.D. 1503, and coins of the same date bear it as a device, but it is found that the drawings of the flower, which appear on these coins, ancient carvings, coats of arms, and painted glass, all differ from each other, and they cannot be recognised as belonging to any known species.

It was not until thirty-seven years later, in A.D. 1540, that the Noble Order of the Thistle was instituted with the thistle as its badge, and only in the time of James I. of England that the Order assumed its present high regard.

* A poem by William Dunbar, composed on the occasion of the marriage of James IV. of Scotland with Margaret, eldest daughter of Henry VII.

Towards the identification of the exact species, the plant that has been cultivated in Scotland as representing the country's symbol is the Cotton Thistle (*Onopordium acanthium*), and he who will venture to gather a fine specimen of this sturdy plant, growing from four to six feet high, will readily understand that the Danish soldier had good cause to cry out with pain when he trod on its exceedingly prickly foliage, and that the plant justifies the well-chosen motto of the Order—"No one provokes me with impunity."

In passing, it may be of interest to note that the cotton thistle is a rare plant in the south, but a good patch of it flourishes on the sandy coast of North Somerset within the Bristol district.

We may now pass on to the emblem of the sister island—the Shamrock or trefoil. Here again the origin is lost in the myths of antiquity, and whilst sentiment associates it with St. Patrick, who taught the doctrines of Christianity to the pagan Irish people in the 5th century, there is no mention of the plant in any history of the saint that has come down to us. The shamrock is constantly referred to in mediæval writings of the country, but without mention of what leaf is intended, and as you know this has permitted many three-leaved plants to claim the honour.

In the 16th century an English herbalist paid a visit to Ireland, and he has left on record the statement that the Irish willingly eat the herb shamrock, it being "of a sharp taste," and this would point to the acrid wood-sorrel (*Oxalis acetosella*) as the plant then held in such esteem. It must, however, be remembered that the wood-sorrel is scarcely in leaf so early as St. Patrick's Day, which falls on the 17th of March, unless, perhaps, a few examples might be met with in well sheltered spots here and there in the Island.

The patriotic sentiment which induced the Irishman to display the national badge on this festival has made it necessary, in modern days at least, to raise to the honour some three-leaved plant, which could be obtained in plenty and fully grown by the middle of March. Such an one was found in all the meadows and grassy places throughout the country in the small yellow trefoil (*Trifolium minus*), a dainty little green plant spread out flat on the ground in early spring with branches an inch or two long bearing very tiny trifoliate leaves. Whatever may have been the shamrock in the past there is no doubt that this small clover is now closely associated with the history of the Irish, and for that reason it becomes an object of interest to us when we meet with it in our fields and roadsides.

At times the white Dutch clover (*Trifolium repens*) has been suggested as representing the national badge, but it is known that the species is not indigenous, and was first introduced into Ireland as late as the 17th century to become common there by cultivation as a fodder plant.

The little kingdom of Wales, early united to her more powerful neighbour England, has also a distinctive badge drawn from the vegetable world. The origin of the Welsh leek, as with the

other national badges, is lost in the traditions of early times. The Christian religion was brought to Wales from the north of Ireland, and at once took a strong hold on the fervent imagination of the Welsh nation, and a patron saint became a part of its every day life. About the year A.D. 540 the Archbishop, known to us as St. David, was on his death regarded, by virtue of his learning and noble life, fit to be the chief patron, and the 1st of March became the annual day set aside in his honour. Just about one hundred years later the Welsh princes gained a great victory over the Saxons, who were trying to occupy their territory, and as this battle was fought on March 1st the success was naturally attributed to the direct influence of their patron saint, and in some way it came about that henceforth the leek was regarded as the emblem of St. David, and therefore the device of the Principality. The reason why the leek was chosen is a matter of tradition and not of actual history. It is usually stated that at the time of the battle the Welsh troops were passing near a field planted with leeks, and wishing to adopt a badge, which might distinguish them from their enemies, each man thereupon plucked a leek and stuck it in his cap. This could have been possible, as the leek is in full growth in March, as old Tusser, the herbalist, sets forth in one of his quaint couplets.

Shakespeare's play of *Henry V.* abounds with interesting allusions to this custom of wearing the leek as a badge of honour. And the vegetable has always attracted attention, because it has served as an emblem round which Welshmen have rallied on all kinds of occasions during so many centuries.

Within the last few years, however, certain writers have sought to bring forward the wild daffodil to take its place as a substitute. The daffodil is a well-known flower in certain parts of Wales, and has its own distinctive name in the language, but the modern writers find that one of the dictionary names for the flower consists in part of the same word as is used for the leek, and apparently on this account they argue that a misunderstanding has arisen all through the centuries in thinking the leek was intended as a distinctive badge, whilst all the time it was the daffodil that was gathered by the soldiers.

It seems a better reason than this will be needed to displace the highly-honoured leek, but, still more recently, advantage has been taken of the idea. It must be acknowledged that there are times when the leek is not a picturesque plant to insert in an artistic design on a small scale, so it was abandoned by one of our leading artists, Sir W. Goscombe John, of the Royal Academy, when preparing a design into which the emblem of Wales had to be introduced. Accordingly, as the King had no objection, we find the head of a daffodil flower was enamelled on the small gold circlet with which Prince Edward was invested, when he was created Prince of Wales at Carnarvon in July, 1911, and this was the first occasion on which the flower was used to typify the Principality of Wales. This lead has since been followed by

the artist who designed the Health Insurance stamps. If preparatory to putting on one of these stamps you examine the festoon of national emblems you will find in it four daffodil blossoms in different positions.

Of course, from an heraldic and historic point of view the leek holds the field as the emblem of Wales, but for æsthetic reasons the daffodil may on future occasions take its place.

In leaving the badges of the British Isles we may pass on to the floral emblem of our friendly neighbours across the Channel. The origin of the fleur-de-lis in the arms of France has furnished an ample field for controversy. Whatever may be the source of the device, it has played an important part in the history of the nation and has a special interest for Englishmen, because for five hundred years three fleurs-de-lis were included in the British coat-of-arms, in order to maintain the claim that our monarchs were also kings of France.

From early times the flower of the lily was associated with the Virgin Mary, and various Frankish kings adopted it as a proof that they were heaven-appointed monarchs. Such a feeling must have influenced Louis VII. of France in the middle of the 12th century, when, excommunicated by the Pope, and his kingdom laid under an interdict, he determined to take a leading part in the second Crusade of A.D. 1147, and thereupon assumed a personal cognizance emblazoned on his banner to serve as a rallying sign for his host of followers. He chose the iris, or lily as it was called in those days, and on his return from Palestine, the flower became celebrated as the national emblem, and was not only used in the arms of France, but employed in the decorative embellishments of the crown itself. Henceforth it was known as the Fleur-de-Louis, probably a rebus on the king's name, subsequently as Fleur-de-Luce, and in less accurate times as Fleur-de-lis.

It may be remembered that Shakespeare writes of "lilies of all kinds, the flower de luce being one," as though they were different plants, but from the time of Turner in the 16th century onwards, all the botanical writers identify the iris as the Lily of France, and with this judgment most modern writers agree.

The form of the fleur-de-lis bears out this origin, for although it is represented in art and sculpture with many variations, in all of them can easily be recognised the conventionalised shape of the upper petals of the common yellow iris or flag, when fully expanded and viewed from the front.

From its historical association no prouder emblem can be met with amongst our native wild flowers. To refer to its place in later history we find the fleur-de-lis in combination with the lions of England for the first time in A.D. 1299, on the occasion of the marriage of Edward I. with his second queen, Margaret of France.

A century later, when Edward III. claimed the crown of France he reduced the number of fleurs-de-lis on the arms of England, and from that time the well-known group of three flowers remained,

until A.D. 1801 when, on the union of Ireland, it gave place to the harp, and to our neighbours was restored the full possession of their ancient heraldic flower.

There are some floral badges adopted by prominent characters in history that is a pleasure to recall. One of these is the Broom, which, under its early Latin name, *planta genista*, has given its name to the Royal house of Plantagenet amongst our early kings. With this plant historical facts seem to be established, although it is to be feared a picturesque setting has crept into the history of it. This much, however, seems to be worthy of credence, that, some years before the first Crusade of A.D. 1096, an Earl of Anjou undertook a pilgrimage to Jerusalem in order to expiate his cruelties in France, and he assumed the broom as his badge. It is thought he chose this plant because it was considered to be, amongst the religious Orders, an emblem of humility on account of its lowly stature, and from its love of barren and rocky slopes. On the Earl's return, as a sign of his penitence, he bequeathed a sprig of the golden blossom as a cognizance to his family, and as the Crusades did much to encourage the art of fighting in combined forces the Counts of Anjou chose to continue to rally their followers on the field of battle under the banner of their country's beauteous wild flower.

Nearly a hundred years later when Geoffrey of Anjou became the second husband of the Empress Matilda, the only daughter of our King Henry I., he used it as a crest, and adopted the surname of Plantagenet—a broom plant. Their son came to the throne of England as Henry II., and was the first of the long race of Plantagenet kings, who continued to rule till the death of Richard III. in A.D. 1485.

The plant has thus a strong claim on our interests, and that the dynasty was proud of the emblem of the broom is shown by Richard II. having the blossoms engraved on the Great Seal of England; and further, you may know the copper effigy on his tomb in Westminster Abbey, which represents him in a mantle embroidered all over with the open seed pods of his ancestral badge.

As we find the broom associated with the House of Plantagenet, so the hawthorn or May blossom is connected with the succeeding House of Tudor. Henry VII., besides his badge of the red and white roses, adopted the device of a hawthorn bush enclosed in a crown to commemorate his victory at Bosworth, where he was proclaimed king on the battlefield, and crowned forthwith with the battered coronet of his predecessor, Richard III., which was found near by hanging in a hawthorn tree.

This is one of the many instances in which the choice of a badge may spring from a simple incident, and for centuries afterwards retain a hold upon the popular imagination, as is recalled in this case by the proverb—"Cleave to the crown though it hangs on a bush."

The familiar name of May Blossom has reference, of course, to the use of the flower in the decoration of the May-poles of England in the great festival of that month.

The bright blue blossoms of the Forget-me-not, the very name of which breathes the romantic but legendary story of the German knight and his lady love, served as the badge during his exile of the banished Henry of Lancaster, who united this flower of remembrance to his collar of SS. with the motto in old French—"Soveigne vous de moi" (Remember me) as a hint to his friends in England. And the rapturous welcome accorded to him by his partisans, when he subsequently ascended the throne as Henry IV. showed that though "out of sight," he had not been "out of mind."

In more recent times the modest Violet has been associated with a somewhat similar cause in the history of the French people. When misfortune overtook the Emperor Napoleon Bonaparte, and he was banished to Elba his favourite flower, the blue violet, was adopted as a badge by his faithful adherents, who invested it with the secret significance "To return in Spring," to show their belief in the ultimate success of their leader.

In the following March their expectations were realised by the Emperor's reappearance in France, but his triumph was short-lived and a few months later saw him removed to a still more distant place of exile.

The violet, however, remains the badge of the Bonaparte party under the modern Republic, and was largely used, as you may remember, at the funeral of the Prince Imperial.

There is still one flower to be added to these historical memories which, though it has not had the good fortune to be amongst the emblems of nations or the badges of royal houses, has, apart from its beauty, an interest worth recording. To the botanist the brilliantly-coloured Gorse or Furze, the glory of our downs and hill-sides, will ever hold an honoured place in the pages of history, because of its association with Linneus, who did so much for botany. Nowhere is the gorse found in such abundance or in such beauty as in England, and it is not surprising, therefore, that the great naturalist, who had never seen the plant in his native country, should be so moved by the sight of a common, near London, ablaze with the brilliancy of its fully expanded blossoms, that he fell on his knees enraptured, and thanked God for sparing his life to see this beautiful part of the Creation.

A later testimony to the glory of the plant comes from the late Dr. A. Russel Wallace, who wrote that he had never seen in the Tropics such brilliant masses of colour as England can show in her furze-clad commons.

It would be possible to enumerate other flowers, such as the Bluebell of Scotland, and the many floral badges of the Scottish clans, that have played a prominent part in the history of the nation, but you may think that romantic legend is creeping too much into my remarks, whereas I wish them to stand as interesting facts from history.

January 22nd, 1914.

Fifty Years of Botany in Bristol.

BY JAS. W. WHITE, F.L.S.

THE period covered by the life of the Bristol Naturalists' Society has been a period of enormous scientific progress, involving many changes in the educational and industrial systems of the country, and corresponding alterations in the mode of life of its inhabitants. It may not, perhaps, be easy to determine if the advances of science, in a general sense, during the past fifty years have exceeded in importance those achieved in the earlier half of the nineteenth century ; but there can be no question that the study of the so-called natural sciences, and of biology in particular, has been pursued with an energy and success unrivalled in any previous epoch.

The doctrine of evolution as we have it to-day is essentially a modern product—a necessary outcome of latter-day developments in physical science—and in its establishment ideas and evidence gleaned from the behaviour of vegetable organisms have had no small share. Its probable working in the history of organic processes has been more clearly revealed to us by the hypotheses of Darwin and Wallace, and it may here be remarked that not the least forcible of its indications points to a valid and welcome explanation of the occurrence of plant-variations and races, and a possible solution of the species problem.

Apart from London and the older Universities scientific teaching in schools, either public or private, was practically non-existent in 1862. The medical curriculum of that date did include botany, and therefore courses of lectures on the subject were delivered in provincial medical schools by local lecturers, themselves often practitioners in the town. This was the case in Bristol. Other botanical aspirants, whose way in life lay outside medicine, had to make shift for themselves with books and kindred spirits. People groping in the dark are always glad of company—they cling together whenever practicable—and it may well be that a feeling of that kind has materially helped to bring about the formation of Naturalists' Societies. Present-day students know little indeed of the conditions under which a training in science could be obtained by their forerunners in earlier generations. Higher Grade Schools and University Colleges, where lecturers and laboratories are provided for instruction in pure science at low fees, are recent creations. They have come into being during the period here reviewed.

In the realm of botany, within the last few decades, we have had a great revolt. The systematist, who for centuries had ruled and directed all the botanical teaching that was attempted, has been deposed. The study of plants in the field, their recognition, classification and relationship to each other by comparison of

external characters, has largely given place to laboratory work on anatomy, histology and physiology. In these departments botanical research of a high order is now conducted in established schools of science—schools that have arisen since the birth of our Society. Some of us may think that this revulsion has gone too far, as such movements are wont to do. Field botany, however, is already recovering some of the lost ground; and the belief can still be entertained that to identify a plant when met with, and to learn its scientific place and appellation, is one of the very first and most important steps in botanical training, although it is true that those who are interested in the wider problems of systematic botany have to consider a recent theory, authoritatively expressed, that a separation of species on morphological grounds alone is unsatisfactory. It is evident that the practical pursuit of ecology, for example, is only for students who have acquired an intimate acquaintance with native plants as they live and grow. Let us hope that in due time many zealous followers of Bentham and Babington may emerge from among the young folk who, just now, in "Nature Study" classes and on rambles, seem to think that nothing can be done with less than an armful of specimens, not always, unluckily, of the commoner kinds.

On a contemplation of the happenings during fifty years, thoughts come to one's mind in random fashion. For the present purpose it will not be necessary to set them all forth in sequence. It may suffice to jot down three or four.

Modern investigation has broken down the apparently clear distinctions between flowering and flowerless plants. The groups of Lichenes, Fungi and Algæ have run one into the other, and when the lowest forms of such plants are alone considered, even the animal and vegetable kingdoms cease to have a definite frontier.

The detection of natural hybrids and the recognition that they form an appreciable portion of the flora of the country is a feature of consequence in latter-day botany. Many plants that were once regarded as good species are now known to be the produce of hybridization, proof having been obtained by effecting the process artificially. In the neighbourhood of Bristol numerous hybrids—primary, secondary, or more complex—are found among the *Epilobia*, *Salices* and *Carices*, and their production seems easy also with *Brambles*, *Roses*, *Thistles* and *Mints*. These facts afford one reason why, apart from exploration and nomenclature, the local naturalists who were steadily gathering details respecting the wild plants of this district with the view of marshalling them within the pages of a *Bristol Flora*, found their work become heavier and more critical than formerly. Hybrid *Narcissi* and *Primulæ* have recently been produced and studied in the garden of Mr. Philip Worsley, one of our oldest members. Natural hybrids between species of distinct genera are very rare, but several such instances have occurred in *Orchidaceæ*.

The industry of observers in tracing the distribution of plants, not only in the Bristol district but in all parts of the British Isles, since the appearance of our earliest catalogues and local lists, has been remarkable and shows no sign of slackening. A like energy during the same period has been expended in the critical study of plant-forms or variations, both in the field and in herbaria. This study, which becomes more and more minute as the years go by, has led to the description and definition by name of a vast number of variations. The old limitations of species and lower grades into which plants had been divided have, in fact, practically disappeared and are no longer recognizable. As a result genera that contain plastic or polymorphic groups with numerous slightly differentiated forms, like *Cratægus* and *Aster* in America, and *Rubus* or *Hieracium* in the Old World, have been rendered hopelessly unworkable to any but the most devoted expert through the adoption and promulgation of "species" and "varieties" based on characters which at one time would have been deemed trivial in the extreme. Thus, botanists are entering on an epoch of specialism, and have already at command a series of Monographs representing the strenuous enthusiastic work of expert students on all the material available in each of these perplexing genera or families. These developments affect us locally through the necessity that arises from time to time for obtaining expert opinion on Bristol specimens of doubtful affinities, and through the intelligent help repeatedly given by skilled non-resident observers in drawing our attention to difficult local forms of the groups above mentioned. The late Rev. Augustin Ley, a most accomplished botanist, was indefatigable in his efforts to disentangle the Cheddar *Hieracia*. Without his aid we should not have understood our *Pyrus* variations, and his incursions were at all times profitable to his friends in Bristol.

The flowering plants actually discovered in Britain during the past half-century may not number more than twenty, but the multiplication of named forms split off from previously known aggregates has lengthened the *London Catalogue of British Plants* from a total of, say, 1,800 species and varieties to something like 2,800 in the last edition; and correspondingly has swollen the grand total of the Bristol phanerogams to over 1,600.

Looking back over so many years the more distant events do not stand out so clearly as one would wish. From a botanical outlook, however, it seems fairly plain that the Bristol Naturalists' Society was founded at a time of profound stagnation. Swete's *Flora Bristolensis* had been published about eight years, and it might be thought that such a book would have given a marked stimulus to local investigation. But the author's professional calling led him elsewhere. He left the city almost at once, and his band of helpers speedily melted away. We find no note of supplemental work on the flora in the decade that followed. Herr Adolph Leipner, the first secretary and the soul of our Society for

more than twenty years, was an enthusiastic naturalist and a gentleman who enjoyed the affectionate regard of the members he served so diligently. At that time he appeared to be chiefly interested in zoology and the microscope. Later, he became an earnest teacher of botany and was appointed the first Lecturer on that subject in University College. To him we are indebted for the planning and planting of our University Botanic Garden—of considerably larger area than now. Thus it came about in the beginning that papers read at monthly meetings of the Society had little or no reference to botany. Early records of the proceedings show that the members inclined to instruct themselves on geological and physical matters; the anatomy and life-history of reptiles, molluscs and insects; and economic questions relating to such vegetable products as tobacco, textile fibres, rag substitutes and the like. In the seventies Mr. Leipner lectured on "Mosses and their Allies"; and we find him conducting excursions of a Botanical Section on Saturday afternoons. Reports on these rambles merely mention the observation of quite common trees and flowers. Mr. C. E. Broome wrote a paper on "Bristol Fungi," and a list of Desmids observed in the neighbourhood was published by Mr. W. W. Stoddart.

About this time Mr. Cedric Bucknall began an exhaustive study of our local Fungi, to be referred to on a later page. When the supply of fungus-species failed him, this botanist turned his attention to flowering plants; and although that branch of botany was comparatively new to him his industry and capacity in attacking difficult problems have since secured him a high standing among systematists. His critical revision of the genus *Symphytum*, lately published by the Linnean Society of London, will have confirmed and enhanced the author's reputation. In local field-work Mr. Bucknall's observations have helped most usefully in clearing up some misconceptions in the naming of our plants, and have, moreover, enlarged our lists with additional species and varieties, often of considerable rarity. His discovery in the Bristol district of *Stachys alpina*, a plant previously unknown in Great Britain, aroused keen interest among the botanists of the country and induced many to come and view the locality in which it grows.

The present writer joined the B.N.S. soon after his arrival in Bristol in 1874. Although a stranger and a tyro he was induced to undertake for the Society the preparation of a *Flora of the Bristol Coal-fields*—an area that had been chosen as essentially a natural one, well suited for local research, but ten or twelve times larger than that treated of by Swete. This essay originally came out in six yearly parts (1881-1887) published in successive volumes of the Society's *Proceedings*. Its content was about 1,000 species as against 800 that had been observed in Swete's smaller area; and its array of recorded stations for the less common plants was, of course, much fuller, so that it was generally and justly regarded as a satisfactory prelude to the more elaborate work which even

then was contemplated. The compiler of this book was extremely fortunate in his botanical friends and co-workers, particularly in those resident in outlying portions of the district whose help was, of course, invaluable. For example, the neighbourhood of Wells and Glastonbury had become intimately known to Miss Livett and to Mr. Murray the author of the *Flora of Somerset*; while the country between Bristol and Bath and the whole extent of the Chew Valley had been thoroughly explored by the late Mr. David Fry. In after years Miss Livett did good service at Clevedon where she still resides. Mr. Fry was one of the most exact and careful botanists of his day. Taking up the study late in life, he needed but little help in his endeavour to understand our critical plants; those of us who offered to be guides or tutors were speedily outstripped and left behind. His acute mind seemed instinctively to grasp the salient points of any bramble, hawkweed or sedge that presented itself for determination, and he spared neither time nor labour in arriving at the truth. Few, indeed, are the mistakes that could be laid to his charge. Had his energies been directed to botany at an earlier age he would certainly have taken a high place among the expert botanists of the country.

The following are some of the rarer species first detected near Bristol by Mr. David Fry:—*Rubus fissus*; *R. nitidus*; *R. sulcatus*; *R. mucronatus*; *R. Borreri*; *Epilobium Lamyi*; *Juncus compressus*; *Carex acuta*.

A further twenty-five years of persistent field work, shared by other members of the B.N.S. and controlled and tabulated by the same author, culminated in the production of the *Flora of Bristol* (1912). This volume of 700 closely printed pages gives an account of all the flowering plants, ferns and their allies, that have at any time been recorded within the district, aliens as well as natives; with notes on the origin of the flora; the distribution of the rarer plants as affected by rocks and soils; the topography and physical features of the area; and a biographical sketch of the bygone botanists who have engaged in botanical research at Bristol during the past 350 years. The writer and his assistants had abundant reason for gratification on the completion of so protracted a labour. Reviewers and British botanists in general very amiably agreed in commending the work as "a splendid book full of interesting matter" and "an admirable example of how such things should be done."

The natural advantages of our city as a botanizing centre have been in good repute for centuries. Attracted by the fame of her limestone plants and of the Avon scenery, generations of scientific visitors and strangers of all grades have travelled here to sample the rich vegetation that the district affords. And it has happened, now and then, that one or other of such visitors has been the first to point out the presence of very interesting species. Thus we owe *Linosyris vulgaris*, as it now exists, and *Koeleria vallesiana* to Mr. Claridge Druce, of Oxford; *Pyrus intermedia*, *Rubus Gelertii*

R. ericetorum, and *Hieracium rubiginosum* to the late Rev. Augustin Ley of Ross; *Atriplex laciniata* and *Polygonum Raii* to the Rev. E. S. Marshall, of West Monkton; *Cyperus fuscus* to Mr. S. J. Coley, of Stroud; *Cladium Mariscus* to Mr. H. Corder, of Bridgwater; *Carex montana* to the Rev. E. F. Linton, then of Bournemouth; *Carex depauperata* to Mr. H. W. Pugsley, of Wimbledon; and *Eriophorum latifolium* to Mr. C. E. Salmon, of Reigate.

Although the tale of the local flora may owe its numerical superiority in some measure to outside sources of information, yet in regard to our own people it can be justly said that the study of plant life is now more popular than at any former period in the Society's career; so that a kind of continuous stock-taking is going on amid our vegetation. A good deal of this present activity may be traced to the influence of a Botanical Club founded in 1903 by the late Mr. George Brebner, under the wing of the University College of that date. Succeeding Lecturers in Botany continue to hold the presidency, and Miss I. M. Roper, a member of our Society, and its President in this Jubilee year, has been secretary of the Club from the beginning. Her personality and persistence in getting the best out of each individual member are vital to the Club's prosperity. The informality of club-procedure is attractive to those persons, and they are many, who find they profit more by chatting over their gatherings round a table than by attending methodical lectures. Not only vascular plants but bryophytes and fungi make up the "exhibits" discussed at the club meetings, and a number of interesting facts have been brought to notice in this way.

The speeding-up of local phyto-geography has been manifested also of late years by the publication of the *Flora of Somerset* by the late Rev. R. P. Murray, who adopted the records of Bristol botanists for the northern portion of the county; and of a *Monograph of British Violets* by Mrs. E. S. Gregory. The author's special study of this delightful but decidedly intricate genus had its beginning in North Somerset while she resided at Weston-super-Mare; and much of the material on which she worked was obtained from woods and hedgebanks within the Bristol district. A rare knowledge of the details of the subject are here displayed so clearly that few could fail to find what might be needed in making a determination. In a paragraph of her preface Mrs. Gregory speaks of excursions long ago with the late Mr. David Fry and the present writer, and remembers "our walks and talks on the hill-sides and peat moors of Somerset, searching for that which meant more to us than gold, silver or precious stones." Yes, doubtless we all realise that though the rambles we once enjoyed with old friends, and the scenes we witnessed together, may in after years become obscured and colourless, thought revives them and awakened memory illumines them again. Before leaving the district Mrs. Gregory made out for us a number of Violet hybrids

and varieties, and defined the new species, *V. calcarea* Greg. She enriched our flora also with *Cerastium arvense* and had the joy of finding on the N. Somerset coast that solitary clump of *Scirpus Holoschænus* which is the sole evidence of the plant's existence in Britain away from the sand-hills of N. Devon.

The Mendips, the southern lowlands, and the peat moors of our area have been dealt with on the ecological side by Dr. C. E. Moss. His admirable *Geographical Distribution of Vegetation in Somerset; Bath and Bridgwater District* (1907); has placed him in the front rank of writers on the subject. To-day, the Rev. E. S. Marshall is busy with an endeavour to bring the *Flora of Somerset* up to date in a re-issue; and the botany of the wide county of Gloucester is in the capable hands of the Rev. H. J. Riddlesdell, who hopes shortly to let us have his results in print under the auspices of the Cotteswold Field Club.

Turning now to the great group of *Bryophyta*, it appears that the study of mosses has been a favourite occupation amongst us throughout the life of the Society. This preference need not surprise one in the least, for, trifling and insignificant as they seem, these "little plants that lowly dwell" possess an elegance, delicacy and beauty of structure unsurpassed in the vegetation of the globe. Moreover, their pursuit is not restricted to the summer season, but can be taken up throughout the winter, long after all flowering plants are gone to ruin. They grow practically everywhere, are easily preserved, and may be revived at any time by immersion in water.

Mention has been made already of Prof. Leipner's initial lecture. His "List of Mosses of the Bristol District" was published in the Society's *Proceedings*, and his herbarium of specimens is preserved in the Bristol Museum together with the moss-collections of some of his fellow members. Mr. W. W. Stoddart published a further list of local mosses in 1874; and at about the same time a "Preliminary List of Somerset Mosses," by Dr. H. F. Parsons, of Beckington, appeared in the *Botanical Record Club Reports*. In the 'eighties, the Rev. C. H. Binstead was resident at Wells and studied the moss-flora of that neighbourhood. He contributed a list of mosses and liverworts to the *Victoria County History of Somerset*; but the list was very incomplete, only containing about a quarter of the number known to occur in the county. The work of extending it largely devolved on Sir Edward Fry, the late Dr. Parsons, and Mr. W. Watson, of Taunton. The last-named botanist has recently compiled *The Mosses of Somerset* for the County Archæological and Natural History Society. From that complete account some of the particulars here given have been extracted. Among Bristol Naturalists of the last generation Mrs. Lainson, Mr. Edwin Wheeler, and Mr. W. E. Green were diligent moss-students. Mrs. Lainson's Clevedon collection has been arranged in the Weston-super-Mare Museum. The Green and Wheeler herbaria are in private hands. Miss I. M. Roper and Mr.

W. B. Waterfall—both well known members of the B.N.S.—are living authorities quoted by Mr. Watson. Of the 619 known British species it is stated that some 300 occur in Somerset; and it has been computed that at least 200 of these are to be found within walking distance of our city.

On the Gloucestershire side of the district, work among the mosses has not hitherto been so systematic. Dr. G. H. K. Thwaites, the most able Bristol botanist of his day, explored the neighbourhood very thoroughly; and it is said that his herbarium contained nearly all the plants that are now known in the area he visited. That important collection, however, at one time in the Museum of Clifton College, has most unluckily been lost. The moss-flora of Gloucestershire is now in the hands of Mr. H. H. Knight, of Cheltenham. He has the task of eliminating error, so far as practicable, from the available records, and expects in a short time to furnish an adequate statement of the facts. Mr. Knight writes that the following mosses of especial interest have been found in recent years on the Gloucester side of the Avon, about St. Vincent's Rocks and Durdham Down:—*Pottia bryoides* (Miss Roper). *Weisia calcarea* var. *viridula* (W. B. Waterfall). *W. crispata* and *W. crispata* (Miss Roper). *Barbula Hornschuchiana* (J. W. White). *Pleurochaete squarrosa* and *Heterocladium heteropterum* var. *fallax* (W. B. Waterfall).

HEPATICÆ. The Scale-mosses or Liverworts. "A group of plants, not very conspicuous, not to everyone very familiar, but common, and, in some cases, very elegant, and in all cases very interesting; . . . things not of interest only, but of beauty. . . . And even those forms amongst them which have the least obvious elegance, are full of hidden beauties that only await the loving observer to give pleasure and joy."* Yet, with a few notable exceptions, they have been but little appreciated by local botanists. Out of the 4,000 odd species that have been enumerated in the world, about forty are known to grow in the Bristol district. Our member, Mr. E. H. Read, who has studied the subject "not from a statistical or historical side, but for the interest of the plants themselves," thinks that the record of local species might be sensibly lengthened on further close investigation. He gives two main reasons for the apparent neglect of this group. Firstly, many of them are so tiny, requiring keen eyesight and diligent search for detection, while their homes are often in places dripping with water that do not commend themselves to naturalists chary of wetting their feet! Secondly, it is only within the last two years that a handbook within the reach of a modest pocket and containing such reliable descriptions of the plants as should enable an average botanist to identify them, has been available. As rare species growing with some frequency near the city or on Mendip, Mr. Read mentions *Lejeunia Mackaii*, *Reboulia hemisphærica*,

* *The Liverworts, British and Foreign.* By the Right Hon. Sir Edw. Fry, G.C.B., and Agnes Fry, 1911.

and *Jungermannia Wilsoniana*. The latter is a small foliose plant that seldom fruits in Britain, but fruits freely with us. *Frullania dilatata*, with a habitat on the bark of trees throughout the district, is of interest because it harbours a small rotifer (*Callidina symbiotica*) in pitchers at the back of its leaves. *Lunularia vulgaris*, with *Marchantia polymorpha*, has flourished and fruited abundantly around our Cathedral Close, and between kerbstone and gutter in some of the back streets of Bristol. Hepatics and their kindred orders have long been under observation by Sir Edward Fry and his daughter, Miss Agnes Fry. Miss Fry reports that *Riccia sorocarpa* was new to Somerset when she found it on Failand Hill a few years ago; and *Fossombronina pusilla* in fruit, has been gathered by her at Failand in the month of February.

LICHENES. There is a long list of species in the *Victoria County History of Somerset*; but Mr. Watson remarks that very much remains to be done in regard to their distribution. To those who feel inclined to enter upon this branch of research it may be hinted that they can have the advantage of an accessible referee in the present Secretary of the B.N.S., Dr. Darbishire being a European authority on lichens. And a collection of British Lichens has its place in the University Herbaria.

FUNGI. Mr. Cedric Bucknall's scrutiny of Bristol fungi has already been referred to. He eventually gave us a series of lists illustrated by excellent drawings of the more interesting species. His Part I. appeared in 1878, and the work ended with Part XIII. in 1891. Mr. Bucknall has furnished me with the following notes that give details not hitherto published:—

"The *Fungi of the Bristol District* contains 1,431 species collected between 1876 and 1891, with figures of those newly-discovered. Of these more than 100 species were new to Britain or to science, consisting of about 30 *Agaricini* with 5 other *Hymenomycetes*; 9 *Melanconiei*; 18 *Elvellacei* (Pezizæ, etc.); 1 *Phacidiapei*; and 41 *Pyrenomycetes* (*Sphæriaceæ*, etc.). Of the 20 species new to science seven belong to the *Agaricini* and are mostly large and conspicuous plants:—*Agaricus Bucknalli* B. and Br., *A. electicus* Bucknall, *A. eustygius* Cooke, *Cortinarius nitrosus* Cooke, *C. testaceus* Cooke, *C. bicolor* Cooke, *Paxillus lividus* Cooke. The remaining new species are mostly small or microscopic, viz: 6 *Elvellacei*, 1 *Phacidiapei* and 7 *Pyrenomycetes*. Of the figures in Cooke's *Illustrations of British Fungi* (*Hymenomycetes*) 8 vols. (1881-1891) forty-four are taken from my coloured drawings of Bristol specimens; and about a dozen other Bristol Fungi are figured in that work from drawings made by Berkeley, Broome, W. G. Smith or M. C. Cooke himself." A notice of the more prominent mycologists who have worked in the Bristol district is contained in Mr. Bucknall's paper in the *Victoria History of Somerset*, Vol. I., p. 59.

MYCETOZOA. Miss Agnes Fry writes respecting this remarkable family that they were but little studied prior to the inception of

the Bristol Naturalists' Society ; and therefore most if not all of the forms she has identified would have been unrecorded at that time. She intends to communicate an account of her work among these plants, with a detailed list of local discoveries, in the form of a separate paper for publication in the Society's *Proceedings*. Meantime it can be said that the following species are regarded by Miss Fry as of particular interest :—*Lepidoderma Carestianum* var. *Chailletii* Lister ; *Stemonitis splendens* var. *flaccida* Lister ; *Trichia Botrytis* var. *lateritia* Lister ; *Arcyria Oerstedtii* Rost.

ALGÆ. These closely related allies of the lichens and toadstools have as yet been very incompletely investigated. It is known that the late Dr. Thwaites did some work at Bristol on the algal flora of the neighbourhood, and it may be well believed that it was done with accuracy and sound judgment. It is doubtful, however, if any result were put on record, and his microscope specimens, if still existing, will probably have been spoiled. In the *Proceedings* of this Society for 1909 we have an account of five years' observations on the occurrence and reproduction of freshwater algæ in the Fish Pond near Abbot's Leigh, Bristol, by F. E. Fritsch, D.Sc., etc., and Florence Rich, M.A. The authors consider that the study of freshwater algal biology is a recent one, commencing only some twenty years back ; and they give a bibliography of publications dealing with the subject that have appeared during that period. A perusal of this account is commended to those interested in the story of algal communities that people pools and inland waters, their life-history, seasonal changes and other external conditions.

While we realise that the past fifty years form a memorable epoch in the history of Botany, let us hopefully believe that the scientific work done in this department by the Society whose Jubilee we celebrate has been at least of equal value with that accomplished by any other similar body in the kingdom. And if the members would cease to look on their Society as something outside themselves, and would keep in view the fact that they *are* the Society, with power to direct its policy and sustain its credit, then it need not be feared that future records of its achievements will tell a less honourable tale than that which is now told.

Fifty Years' Entomology in Bristol.

ALFRED E. HUDD, F.S.A., F.E.S., AND GEORGE C. GRIFFITHS,
F.E.S.

AN Entomological Section was formed on 12th May, 1864, soon after the foundation of the Bristol Naturalists' Society, of which Mr. Stephen Barton, F.E.S., was elected President; this office he retained till 1898.

Mr. Barton, in his younger days, had been a diligent collector of British Coleoptera and Lepidoptera. In the early 'fifties he visited Australia, and on his return to England brought home a large collection of Natural History specimens, especially Coleoptera, many of which were new to science. Had he published descriptions of these he would have been better known to the Entomological world, but being in business he left this task to others, and several new species were described from specimens in his collection by H. W. Bates and others, some of which were named after him—*bartoni*. He added considerably during his lifetime to the Insect Collection in the Bristol Museum, and after his death in 1898, his niece, Miss Barton-Johnson, gave to that institution a fine collection of Buprestidæ and other insects. When his collections were sold in London in 1899, some thousands of specimens were purchased for the Museum, and now form part of the considerable collections in the Greville Smyth Room.

Many interesting specimens of insects were exhibited at meetings of the Section by Mr. Barton, but he did not publish any papers in the *Proceedings*, though he contributed notes on local insects to the volume on "*Bristol and its Environs*," printed for the use of members of the British Association in 1875, and assisted in the compilation of the local catalogue of Lepidoptera published in our *Proceedings*, Vols. II. to IV., 1877-84.

The first Secretary of the Section was Mr. Edwyn C. Reed, but he only held the office for a short time, sailing for South America in February, 1865, and for a while collecting in Brazil. In September, 1868, he returned home and read at the Section a paper on Entomology in the Brazils. A further paper from his pen was communicated to the General Meeting of the Society in November of the same year. At the same meeting Mr. Reed was elected a Corresponding Member of the Society. Shortly afterwards he went to Valparaiso, and subsequently became Curator of the Museum at Santiago. His last appointment was the Curatorship of the Museum at Concepcion, Chili, where he died in November, 1910. Reed collected both Coleoptera and Lepidoptera, and recorded some of his captures in the *Entomologists' Monthly*

Magazine.* He also published a small work in Spanish on Chilian Butterflies, "Mariposas Chilenas": this appeared in 1877, and subsequently papers on Chilian Hymenoptera. He was a fellow of the Entomological Society of London from 1874 to 1910 and a Corresponding Member of the Zoological Society of London.

In January, 1865, Mr. John Barber was elected Secretary of the Section, but held office only a few months, resigning his post in July of the same year. Mr. Barber was an original member of the Society, and collected Coleoptera and Hemiptera-Homoptera. He appears to have read papers before the Section on the "Wings of Insects," in 1864, and on the genus *Quedius* in 1866. We do not know what became of his collections.

The Secretaryship of the Section was next filled by Mr. George Harding, F.E.S., who retained office until 1896. He collected chiefly Lepidoptera, mainly in the neighbourhood of Stapleton, and added considerably to our knowledge of local species; he also collected Exotic Coleoptera. He contributed papers to the *Entomologists' Monthly Magazine*, and to our *Proceedings*, including a List of Additions to the Bristol List of Lepidoptera (Proc. B.N.S., Vol. VIII., n. ser. pp. 55-59).

Mr. Harding was succeeded by the present Sectional Secretary, Mr. Charles Bartlett, who collects Coleoptera and Lepidoptera, and has done much useful work in arranging the Collection of British Coleoptera in Bristol Museum.

Other original members of the Society interested in Entomology were:—Mr. Henry Bolt, who with Mr. John Bolt, devoted himself to the Lepidoptera: the latter had a good collection of local specimens; Mr. F. V. Jacques, who collected Coleoptera and Lepidoptera about 1850-60. He and Mr. Barton met with several specimens of the rare longicorn beetle, *Lamia textor*, and of the still rarer *Odontæus* (formerly called *Bolboceras*) *mobilicornis* in the neighbourhood of Bristol, neither of these species being now found here.

Prof. Adolph Leipner, one of the most enthusiastic of the early members of the B.N.S., was appointed Hon. Secretary of the Society in 1863, and subsequently held office as President of the Botanical Section, and President of the Society in 1893. An accomplished all-round scientist, he did not give much attention to Entomology.

Mr. Philip H. Vaughan, of Redland, though for a good many years he has ceased to collect, has a very fine collection of

*NOTE.—Mr. Reed was fond of joking, and on one occasion sent a record to a London journal of certain "Coleoptera captured under a dead lion in the Leigh Woods." The journal printed the list but did not mention the dead lion, to the grief of the recorder, the fact being that he had obtained a dead lion cub from the Clifton Zoo and planted it in the woods for the purpose of attracting carrion feeding beetles, such as the species of the genus *Silpha*, *Necrophorus*, etc.

Lepidoptera, and furnished many records to Mr. Hudd's List of the Lepidoptera of the Bristol District. Mr. Vaughan captured the third British specimen of *P. sicula* in Leigh Woods in 1856, and was fortunate in adding *Nepticala pomella* and other *Tineina* to the British list. The Bristol records "Brs" in Stainton's Manual were contributed by him and the late Mr. Sircom.

Mr. W. H. L. Walcott, who died in 1869, discovered several of the rarest species of Bees and Andrenidæ: his collection of Hymenoptera is said to have been one of the finest in England. In Bristol Museum are two cases of bees found by him in the neighbourhood of Bristol. They are much bleached by exposure to light, but well-set, and in good condition. Unfortunately, his collection, no doubt including many species of great local interest, has found a home in Cambridge Museum.

The Rev. C. Weare Braikenridge was a collector of British Lepidoptera and recorded the capture of the local butterfly, *Leucophasia sinapis* at Clevedon and Tickenham many years ago. His fine cabinet of Lepidoptera was recently presented to the Bristol Museum by Mr. W. M. Hale.

Mr. I. W. Clarke became a member of the Society in 1864. He collected Lepidoptera and Coleoptera, and recorded *Vanessa antiopa* from Durdham Down in 1872.

The name of Mr. Alfred E. Hudd, F.S.A., F.E.S., also first appears in the list of members in 1864. He is the author of the "Catalogue of the Lepidoptera of the Bristol District," which appeared in the *Proceedings of the Society* between 1877 and 1884, also of the articles on the Entomology of the district, published on the visits of the British Association to Bristol in 1875 and 1898. He assisted Messrs. Hellins and Buckler in their work of making out the life-history of British Lepidoptera as recorded in the well-known work, "The Larvæ of British Butterflies and Moths," published by the Ray Society. To this he furnished the life-histories of some local moths—*Acidalia incanaria*, *A. interjectaria*, *A. holosericata*, *Botys asinalis*, and others.

Mr. Hudd also edited the "List of the Lepidoptera of Somerset" for the Victoria County History in 1903. The number of species recorded for Somerset in this list is 1,245, whilst that for the Bristol Coalfield is 1,310. Since the publication of the list in the V.C.H. sixty-eight species have been added, bringing the Somerset Lepidoptera up to 1,313 species. Mr. Hudd has also done much in the arrangement of the Exotic Coleoptera in Bristol Museum, and has enriched the collections in that institution by presenting many rare and beautiful *Buprestidæ* and other beetles.—G.C.G.

Mr. H. J. Charbonnier, now one of our hon. members, joined the Society in 1865. His contributions to our literature have been many, and in widely differing branches of Zoology, but here we must particularly refer to his work among the less-known orders

of Insects, especially Hymenoptera and Diptera. Collections of both these orders containing many local species have been presented by him to the Bristol Museum, but perhaps his most valuable and permanent achievement has been his "List of the Diptera of the Bristol District" (Proc. B.N.S., ser. IV., Vol. III., part II.). This contains records of 690 species, and will form the basis for any future work done in this much neglected order in our district.

Mr. Robert Ficklin collected Lepidoptera in the Bristol District from about 1870 to 1890, and in 1878 discovered *Eupithecia jasioneata*, at Lynton, North Devon, a species new to science.

Mr. W. H. Grigg joined the Society in 1870, and from that date until 1890, worked strenuously at the Lepidoptera, including Tortrices and Tineina, in both of which groups he was very successful in breeding many little-known species. He gave up the study of Entomology about 1890, and his fine collection was broken up; the Micro-lepidoptera, however, passed into the possession of Mr. Griffiths.

Mr. George C. Griffiths, F.E.S., became a member of the Bristol Naturalists' Society in 1872 and was elected President of the Entomological Section in 1899, which office he continues to fill. He joined the Entomological Society of London in 1888 and contributed a paper to its Transactions in 1898 on "The Frenulum of the Lepidoptera."* He also made detailed examinations of the Frenulum for the late Mr. J. W. Tutt's book on the "British Lepidoptera, as follows:—Psychides (in Vol. I.); Sphingides (in Vol. III.), and Alucitides (in Vol. V.). Mr. Griffiths has a very extensive collection of Lepidoptera, both British and Exotic, many rare and interesting specimens from which he has exhibited at meetings of the Society and of the Entomological Section.

He has done much valuable work at the Bristol Museum in arranging and classifying the very large collections of Insects presented to that Institution by Lady Smyth, of Ashton Court, and others. His collection of British Lepidoptera, which includes the Tortrices and Tineina collected by Mr. W. H. Grigg, of Bristol, is probably one of the most extensive private collections in the West of England.

A. E. H.

Dr. C. K. Rudge, President of the Society from 1904 to 1906, has studied the Orders Diptera, Hymenoptera and Hemiptera, also the Mollusca.

Mr. Edwin Wheeler collected Coleoptera and Lepidoptera from 1870 to 1890 and made many beautiful drawings of the eggs of

* NOTE.—The "Frenulum" is the loop and bristle which connects the fore and hind wings of many of the moths.

Lepidoptera, which were reproduced in Barrett's "Lepidoptera of the British Islands." He also was engaged up to nearly the time of his death, in making enlarged coloured drawings of the Micro-Lepidoptera, but this work remains incomplete. We should also refer to his beautifully coloured plaster models of the British Fishes, now in the Bristol Museum collections.

Mr. R. M. Prideaux, F.E.S., has collected Lepidoptera in this district, and subsequently in Surrey and Kent, also in Germany and Switzerland. He is the author of numerous articles in the "Entomologists' Record," and furnished illustrations of Lycænid Butterflies to the late Mr. J. W. Tutt's work on British Lepidoptera.

The late Mr. C. J. Watkins, F.E.S., formed a large collection of Coleoptera, Hymenoptera, Hemiptera and Diptera which is now at the Bristol Museum, and in course of arrangement. He wrote the list of Macro-Lepidoptera for "The Fauna and Flora of Gloucestershire," also a most painstaking paper published in the *International Journal of Microscopy* entitled "The Denizens of an Old Cherry-tree." In this he enumerated 8 species of Coleoptera, 1 Orthoptera, 14 Hymenoptera, 1 Lepidoptera, 2 Hemiptera and 22 Diptera; all found in the rotten wood of an old cherry-tree stump.

Mr. V. R. Perkins and Rev. W. Farren White both contributed to the Entomological lists in Witchell and Strugnell's "Fauna and Flora of Gloucestershire," the former being the author of the excellent list of Hymenoptera, and the latter of a paper on the Ants of Gloucestershire.

Dr. F. D. Wheeler, F.E.S., though never a member of our Society, was an enthusiastic collector of Lepidoptera about 1865, previous to his removal to Norfolk, where he became an authority on the Fen insects.

Mr. J. Mason, of Clevedon, a Corresponding Member of the Entomological Section, the meetings and excursions of which he occasionally attended, collected Lepidoptera from 1870 to about 1900, and has added several species to our local lists.

Rev. Joseph Greene, F.E.S., collected Lepidoptera during his residence in Clifton, 1870 to 1890, and added much to our knowledge, especially of the local "pugs"—genus *Eupithecia*.

Mr. Alan Hill, of Almondsbury, studied Lepidoptera, including the Tortrices and Tineina, about 1840 to 1860. This is before the date of our Society, but it is mentioned because he left a record of his captures which proved of great use in the compilation of the "Lepidoptera of the Bristol District," published in our *Proceedings*.

Also before our date, Mr. Sircom, of Brislington, collected Lepidoptera, about the years 1840 to 1850, and added some species

of Micro-lepidoptera to the British list, including *Anacamptis sircomella*, named after him by Mr. Stainton.

In 1852 Dr. John N. Duck, of Portishead, wrote a book entitled "The Natural History of Portishead," containing a list of insects, birds, and wild flowers found in that neighbourhood. His collection of Lepidoptera was given to the Bristol Museum by his sister.

Beside the above, we find in the records of the Entomological Section the names of Messrs. R. Aldridge, J. B. Baron, J. Butler, W. N. Cooper, W. Derham, S. F. Hudd, O. Hunt, J. Hutchins, G. James, R. Last, W. K. Mann, R. Mayes, J. Mountney, A. Nash, A. C. Pass, T. H. O. Pease, J. Preston, E. Prichard, R. V. Sherring, W. A. Smallcombe, E. Spencer, G. Thomson, J. Wallis, C. Wheeler, T. H. Yabbiacom, Colonel Couchman, and Major Broughton, all of whom have helped in extending our knowledge of the Entomology of the Bristol District.

As already mentioned, the number of species of Lepidoptera found in our district is large, being some 1,300, out of about 2,000 species in Britain, but many of those occurring are rare, and our localities seldom afford the very great abundance of specimens often met with elsewhere. The last few summers in particular have been remarkable for the small number of examples of butterflies met with, if we except the pretty holly-blue *Lycæna argiolus*, which has of late become more common in our district. One butterfly has, during the period under review, entirely disappeared from the country-side. This is the Black-veined White, *Aporia crataegi*, which was at one time fairly abundant in certain localities, but has not been found in this district for many years, and even in Kent, where it was last recorded, it is extremely doubtful whether it still exists.

The Bristol District is the only one in Britain which possesses all the species of the genus *Drepana*; this includes our rare "hook-tip" *D. sicula* (*harpagula*) which Messrs. Harding, Butler, Ficklin, Grigg, Mann, Bartlett, and the writers of this paper have taken in Leigh Woods. The eggs of the moth have been obtained, the larva figured and described, and the species on several occasions bred in fair numbers, but its occurrence is still very rare and for some years past no capture has been recorded. Still, we may hope that this, our exclusive possession, so far as Great Britain is concerned, may yet be preserved to us.

Our local *Acidalia*, *A. holosericata* still maintains its position in fair numbers in its very restricted locality on Durdham Down, and another Geometer, *Bapta temerata*, has during the last two or three years become more common.

Amongst the Noctuidæ may be mentioned the capture of a very dark female specimen of *Heliothis armigera* by Mr. J. W. Clarke in 1867, of *Heliothis scutosa* by Mr. Jones at Weston-super-Mare in 1876, of *Catocala fraxini* by Mr. Griffiths in Leigh Woods in

1880, of a larva by Mr. C. Bartlett at Brockley in 1897, from which he bred the second specimen of *Prodenia littoralis* recorded in Britain, and of three specimens of *Epunda lutulenta* by Mr. B. A. Coney at Pucklechurch in 1908, this being a new record for Gloucestershire.

In an Appendix to the List of Somerset Lepidoptera just published by the Somerset Archæological and Natural History Society, under the editorship of Mr. Hudd, we also find a record of the capture of *Agrotis lucerneæ*, not previously known in Somerset, at Crook Peak by the Rev. S. O. Ridley in 1913, and of *Agrotis lunigera* in the same locality by Mr. Ridley, the only previous capture of the species being by Mr. Slater at Dunster.

In the two parts of this Appendix which have appeared since the publication of Mr. Hudd's "List of Somerset Lepidoptera" in the Victoria County History, no less than sixty-eight species of Lepidoptera new to the County are added, but we regret to find that all, except the two species named above, are from the central and western portions of the County, beyond the limits of the Bristol Coalfield. The authors of the list remark upon the absence of new records from Bath, Bristol, Clevedon and Weston-super-Mare, and speak of these districts as "more or less unexplored regions." We fear the Bristol Lepidopterists must plead guilty to neglect of the fauna which lies at their doors.

COLEOPTERA. The List of this Order in the Victoria County History attributes 895 species to the County of Somerset, but this is certainly very incomplete, as beetles are well represented in this district, and it is on record that the late Mr. S. Barton captured in one season upwards of 350 *species*, exclusive of *Brachelytra*. It certainly seems that the time has come for local Entomologists to take in hand a list of this great Order. Among the rare and local species to be met with may be named *Cincindela maritima* at Weston-super-Mare and Burnham, and in the Leigh Woods, *Lycinus depressus*, *Hypulus quercinus*, *Strangalia aurulenta*, *Cychrus rostratus* and others. The rare *Eros minutus* was captured in some numbers in Leigh Woods by Mr. E. C. Reed in 1863, but afterwards remained unnoticed until the visit of the British Association to Bristol in 1875, when Messrs. E. C. Rye and R. McLachlan both captured specimens.

HYMENOPTERA. The district has this Order very well represented, as is evidenced by the excellent list of Gloucestershire Hymenoptera by Mr. V. R. Perkins, already referred to. Most of the commoner bees and wasps are to be found, but, perhaps, fortunately, the hornet is very rare locally. *Bombus elegans* and *B. cullumanus* have only been found in one or two other localities. Many genera of solitary bees are also well represented including *Colletes*, *Sphecodes*, *Andrena*, and *Halictus*, the very rare *Sphecodes subquadratus*, *Andrena ferox* and *A. aprilina* having all occurred in the neighbourhood.

HEMIPTERA. The Order has been very little worked in the district, but some rare and local species have been recorded ; amongst others, *Salda pilosa* on the Severn bank, under seaweed, and *Notonecta maculata* in ditches at Ashton, also at Glastonbury by Mr. Dale.

HOMOPTERA. *Ledra Aurita* has been taken in the Leigh Woods by Mr. Charbonnier, and at Portbury. *Macropsis lanio* has occurred at Shirehampton and Batheaston, and *Tettigonia viridis* at Stapleton and Batheaston.

DIPTERA. We have already referred to Mr. H. J. Charbonnier's list of the "Diptera of the Bristol District" recording 690 species : this number will undoubtedly be greatly augmented when the district is thoroughly worked. Amongst rare species we may note *Epidapus scabiei*, a minute gnat bred by Mr. Charbonnier from decaying Narcissus bulbs in Clifton, the only other record of the species being by Mr. A. D. Hopkins in Proc. Ent. Soc., Washington, Vol. III., p. 149. *Oncodes pallipes* taken on Leigh Down, and also recorded from Wells. Mr. Charbonnier captured one specimen of the very rare *Rhagoletis cerasi* in the garden of Bristol University

NEUROPTERA AND TRICHOPTERA. The list of insects of these two small Orders given in the Somerset County History is very meagre, but there seems good reason to believe that it should be largely extended. Several species of "Lace-wing flies," *Chrysopa*, occur in the woods at Leigh and Portbury, and one of the *Hemerobiidæ*, *Psectra diptera*, taken at Langport, by Mr. C. W. Dale, is the sole British specimen known, and only six others have been taken in Europe.

G. C. G.

Bristol Zoology of the past 50 Years.

BY H. J. CHARBONNIER.

IN 1864, the founder and first secretary of the Bristol Naturalists' Society, Prof. Leipner, planned a complete mapping out of the Bristol District for the purpose of systematically recording all the plants and animals occurring therein. For this purpose the geological maps of 10 miles round Bristol, published by our first President, William Sanders, F.R.S., were used, the maps being ruled in one mile squares; this plan was eventually abandoned and the area included in the "district" considerably enlarged.

The more popular sciences of Botany, Geology, and Entomology were the first to receive attention; and though a Zoological Section was formed in 1865, with Dr. H. E. Fripp for president, who contributed several valuable papers on Zoology to the *Proceedings*, notably on "Monad Life" in 1870, yet the Zoological Section was eventually given up for want of support.

In 1867 Dr. C. T. Hudson, LL.D., contributed several important papers on "Bristol Rotifers," these were published with illustrations in the Society's *Proceedings*.

In 1874 Prof. Leipner contributed a list of the "Land and Freshwater Mollusca" of the district, for which he had the valuable assistance of the Misses Hele and Jellie who had collected in the district for many years, 101 species, and a large number of varieties are recorded in this list.

The much neglected orders of Fish, Amphibians and Reptiles had a list of local species contributed to the *Proceedings* in 1886, by the present writer.

In 1888 on the occasion of the British Association's visit to Bath, I contributed to a magazine called *Scientific News*, several articles on the Zoology of the Bath District, both Vertebrate and Invertebrate.

Again, on the occasion of the same Society's visit to Bristol in 1898, Prof. Lloyd Morgan and myself contributed to the "*Hand-book*" of the district a list, with notes, of 27 species of Fish, 5 species of Amphibians, and 4 species of Reptiles.

Coming next to the more popular class of Birds, an excellent list of the species occurring in the district was contributed in 1875 by Mr. Edwin Wheeler, this list dealt with 168 species; Mr. Wheeler had a fine collection of local birds, beautifully mounted by himself; these may still be seen in the Museum of the Clifton Zoological Gardens. He also made many beautiful drawings of fish, and personally painted some of the specimens in the Bristol Museum.

Many interesting papers on Birds were read at the meetings of the Society by Messrs. H. C. Playne and Claude Druitt, both of whom have, unfortunately, left the district.

On that most fascinating subject, the habits and instincts of Birds and Animals, reference must be made to Prof. Lloyd Morgan's work on "The Infancy of Birds," as well as to Mr. Playne's lecture on "Summer Visitors to the Neighbourhood of Bristol" (1899), and some charming bits of Life Histories contributed by Mr. Percy Leonard, "Observations on Mice," and "A Pair of Blackbirds" (1891), and also Mr. Claude Druitt's studies of "Woodpeckers and Owls" (1894).

In 1898 an Ornithological Section was formed to draw up a list of the "Birds of the District," published in the *Proceedings*. From this list (197 species) all the species that might not reasonably be expected to occur any season, were rigorously excluded.

Turning to Mammalia, in 1909 a list of these by Dr. C. K. Rudge and myself appeared in the *Proceedings*, and also in the *Local Handbook* prepared for the British Association in 1898, Prof. Lloyd Morgan and the present writer gave an annotated list of 33 Species.

Many rare local birds and animals have been exhibited at the meetings, the most notable birds being 3 Bee-eaters obtained by Mr. George Harding at Stapleton, in 1869 (now in Bristol Museum), "Pallas' Sand Grouse," in 1888, and the "Pomarine Skua" (1879-80). The most remarkable mammals recorded were the Rorqual stranded on the Severn shore which was described and figured in Vol. IV. of the Society's *Proceedings*, and the "White-winged Bat" exhibited in 1901.

Outside the Society, but dealing with the local fauna, there have been many interesting publications: as, for instance, Cecil Smith's Birds of Somerset, in 1869, and the Rev. Murray A. Matthew's revised list of Somerset Birds in the *Proceedings* of the Somerset Archæological and Natural History Society for 1893. In 1903 appeared the "Victoria History of Somerset," in which Colonel Linley Blathwayt gave a list of 258 species of Birds. The article "Mammals" in the same volume was written by myself.

In 1892 appeared the "Fauna and Flora of Gloucestershire," by Messrs. Witchell and Strugnell, an ambitious fragment of a local fauna, which, however contains some useful notes. Another charming little book containing many local notes on the fauna, is Theodore Compton's Winscombe Sketches, published in 1882.

Locally, nothing in matters zoological is more notable than the wonderful development of the Bristol Museum: besides many local specimens of great interest it has a small collection of local birds, presented by William Henderson, Esq., in the first bay of the large room.

Much has been done in this past half-century, but *very much* more remains to be done, and we may hope that with the immense increase of opportunity, the next half-century will produce a vast increase in the *number of the workers*. They have been so few in the past!

Fifty Years Geological Research in the Bristol District, 1862-1911.

By S. H. REYNOLDS, M.A., Sc.D., F.G.S.

THE varied character of the geology of the Bristol district has led to the publication of a very large number of papers dealing with this subject. In the appendix to H. B. Woodward's 'Geology of the East Somerset and Bristol Coalfield' (1876) a chronological list of 750 is given, up to and inclusive of the year 1875, and in the lists published in the last and present numbers of the Bristol Naturalists' Society's Proceedings 466 more are enumerated. Of this total of 1,216 papers, 755 come within the period under consideration.

In a brief summary of the kind here attempted only the outstanding papers can be alluded to. It seems best for purposes of description to sub-divide the period approximately into decades.

1862-1869.

The year 1864 is noteworthy in the history of geological research in the West of England for the meeting of the British Association at Bath, and for the publication of William Sanders' geological map of the Bristol Coalfield. The completion of this map, published in nineteen folio sheets, is a marvellous achievement for one man. It must be remembered that Sanders had not, like the modern field geologist, the accurate 6-inch Ordnance Survey topographical maps to work on, but had to produce his own maps by reducing 220 parish maps to the 4-inch scale. The Bath meeting of the British Association was under the presidency of Sir Charles Lyell, and his address had a strong local bearing, being largely concerned with the hot springs of Bath.

The Senior Secretary of the Geological Section at the Bath meeting was Charles Moore, who in the long list of illustrious geologists who have studied the rocks of the south-west of England will assuredly always hold a foremost place, both for the importance of his discoveries, and for the stimulating effect of his enthusiasm on other workers. Much of his work belongs to an earlier or to a later period than the eight years now under consideration, but within this period come his well-known papers on 'The Middle and Upper Lias of the S.W. of England'¹ (1867) and that on 'Abnormal Secondary Deposits in Somerset and South Wales'² (1867). The latter paper, in which he proved the Liassic age of the curious crystalline limestones which are met with at Shepton Mallet and elsewhere, resting on the Carboniferous Limestone, may be considered a classic.

Dr. T. Wright, of Cheltenham, best known for his work on Jurassic Cephalopoda and Cretaceous and Jurassic Echinoidea, was

¹ Proc. Somerset Arch. and Nat. Hist. Soc., Vol. XIII, pt. 2, pp. 119-244.

² Q.J.G.S., Vol. XXIII, pp. 449-568.

a contemporary of Moore's, and, as is remarked by Mr. Winwood in his account of Charles Moore and his work,¹ there were many passages of arms between these local champions.

The earliest years of the Bristol Naturalists' Society were also those in which Prof. W. Boyd Dawkins, still happily with us, published some of the most noteworthy of his many important researches on the caves of the South-West of England and their inhabitants. In 1862 and 1863 appeared his famous papers on the *Hyæna* den of Wookey Hole,² by which the contemporaneity of man in Britain with the extinct Pleistocene mammals was first established. These papers were followed in 1865 by one on the 'Fossil mammals of the cavern and river deposits of Somerset,'³ and in collaboration with Mr. W. A. Sanford by one on the caves of Burrington Combe.⁴

The first part of these authors' monograph on the Pleistocene mammalia published by the Palaeontographical Society, appeared in 1866, the introduction being of particular interest to Bristol geologists. Prof. Boyd Dawkins' local work at this period was not confined to caves and their faunas, but included his well-known paper on the Rhaetic and White Lias of Western and Central Somerset⁵ (1864) in which he announced the discovery for the first time in England of the remains of a Triassic mammal. This fossil was found in the grey marls below the Bone-Bed at Watchet.

In 1864 appeared the first of the long series of papers on the Coal-beds of Somerset⁶ by the late Mr. J. McMurtrie.

1870-1879.

To this decade belong most of the long list of papers on local geology contributed to the Bristol Naturalists' Society's Proceedings by W. W. Stoddart, though perhaps his most valuable paper, that entitled 'Notes on the Lower-Lias beds of Bristol',⁷ was published in 1868. His detailed account of the whole succession from Silurian to Jurassic, with fossil lists and illustrative sections must always be referred to by subsequent students of these rocks.

The Rev. H. H. Winwood in 1871 contributed the first of his many papers⁸ to the Proceedings of the Bath Natural History

¹ Proc. Bath Nat. Hist. and Antiq. F. Club, Vol. VII, pp. 232-269.

² Q.J.G.S., Vol. XVIII, (1862), pp. 115-125; *ibid.* Vol. XIX, (1863), pp. 260-273; and Proc. Somerset Arch. and Nat. Hist. Soc., Vol. XI, pt. 2, pp. 197-219.

³ Rep. Brit. Ass. (Bath), Trans. of Sections p. 53.

⁴ Proc. Somerset Arch. and Nat. Hist. Soc., Vol. XII, pt. 2, p. 161.

⁵ Q.J.G.S., Vol. XX, pp. 396-412.

⁶ G. C. Greenwell and J. McMurtrie, "The Radstock portion of the Somersetshire Coalfield," 8vo., *Newcastle-on-Tyne*.

⁷ Q.J.G.S., Vol. XXIV, pp. 199-204.

⁸ Notes on the Rhaetic Section, Newbridge Hill, Proc. Bath Nat. Hist. and Antiq. Field Club, Vol. II, No. 2, pp. 204-211.

and Antiquarian Field Club, while H. B. Woodward, who had been for some years engaged on the Survey of the Bristol District, published between 1870 and 1875 twelve papers on local geology. In 1876 appeared his geological survey memoir on the West Somerset and Bristol Coalfield. Not the least valuable part of this well-known memoir is the list of publications on local geology already alluded to.

E. B. Tawney's all too short connection with Bristol as curator of the Bristol Museum (1871-1879) was noteworthy for the publication of a varied series of papers having a local bearing, those on 'Dundry gasteropoda'¹ (1874), on 'Trias dykes'² (1875), and 'On the Lias in the neighbourhood of Radstock'³ (1875) being published in the Bristol Naturalists' Society's Proceedings. Bristol geologists also owe much to him for his work in the development of the Bristol Museum. R. Tate (1875) also described the Radstock Lias.⁴

Moore's wide geological activity continued during this period, during which his attention was particularly directed to the Pleistocene deposits and their fauna, as is shown by his papers 'On the Mammalia from the drift deposits of Bath'⁵ (1870), and 'On the Banwell Bone Cave'⁶ (1877).

The meeting of the British Association at Bristol in 1875 proved a considerable stimulus to geological work in the district. The President of the Geological Section, Dr. T. Wright, gave an address which his successor as President of the Section at the Bristol meeting in 1898—23 years later—said might serve as a textbook on the geology of the district. Much was written at this time by J. McMurtrie, H. B. Woodward, and others, on the geology of the Mendips, particularly on a subject which proved one of geological controversy during the succeeding decades, viz., the relation to the surrounding rocks of certain isolated masses of Carboniferous Limestone at Luckington and Vobster.

1880-1889.

The earlier part of this period coincided with Prof. Sollas' tenure of the Professorship of Geology and Zoology at the University College, Bristol, and with his Curatorship of the Museum. Among his local papers attention may be drawn to the extremely valuable general account of the geology⁷ prepared for the visit of the Geologists' Association to Bristol in 1880.

¹ Proc. Bristol Nat. Soc., n.s., Vol. I, pp. 9-59.

² Ibid. pp. 162-166.

³ Ibid. pp. 167-189.

⁴ Q.J.G.S., Vol. XXXI, pp. 493-509.

⁵ Proc. Bath Nat. Hist. and Antiq. Field Club, Vol. II., No. 1, pp. 37-55.

⁶ Trans. Cardiff Nat. Soc., Vol. IX, pp. 64-66.

⁷ Proc. Geol. Ass., Vol. VI, pp. 375-391.

Mr. Winwood published numerous local papers during this period, those on 'A Rhaetic Section at Kelston'¹ (1884), on 'The Geology of the Bath District' (British Association Handbook, 1888) and a 'List of the fossil mammalia found near Bath'² (1886) may be specially mentioned. Messrs. McMurtrie and H. B. Woodward continued to write on the geology of the Mendip region, and further facts and theories were brought forward regarding the Vobster section by Mr. Winwood³ (1882), and Mr. W. A. E. Ussher⁴ (1888).

The period 1880-1889 was noteworthy for the earlier of Mr. E. B. Wethered's important researches into the minute structure of the sedimentary rocks of the Bristol District. By the application of the microscope to the study of thin sections, and by the examination of insoluble residues, he to a large extent broke new ground. In the period under consideration he published about ten papers on this branch of geology, some dealing with the Carboniferous rocks, others with the Jurassic. The most noteworthy of his researches were probably those describing the structure of oolitic and related rocks, in which he was one of the first to show the important part played by lowly organisms, now generally grouped with the calcareous algæ.

The retirement in 1883 of Prof. Sollas from the Curatorship of the Museum was followed by the appointment of Edward Wilson, the importance of whose influence on the study of local geology during his fourteen years tenure of the Curatorship was very great. The most valuable local paper published by him during this period was that 'On the Bone-Cave or Fissure of Durdham Down'⁵ (1885), in which the information obtained since the fissure was first described in 1842 was summarized and discussed. The importance of his services to the cause of geology lay, however, quite as much in his enthusiastic development of the geological side of the Bristol Museum, and in the kindly encouragement which he gave to younger workers, as in his published papers.

Prof. Lloyd Morgan's connection with Bristol also commenced in 1883, and the value of his work in teaching at the University College, in stimulating an interest in geology by popular lectures and by the conduct of field excursions, and in local research can scarcely be over-estimated. No less than twelve important local papers appeared from his pen during the years 1884-1889 all but one being published in the Proceedings of the Bristol Naturalists' Society. Particular attention may be drawn to those on 'Sub-aerial denudation and the Avon Gorge'⁶ (1884), 'The Geology

¹ Proc. Bath Nat. Hist. and Antiq. Field Club, Vol. V, No. 3, pp. 220-224.

² Ibid, Vol. VI, No. 1, p. 95.

³ Ibid. Vol. V, No. 1, pp. 24-31; and Geol. Mag., new ser., Dec. 2, Vol. IX, p. 238.

⁴ Rep. Brit. Ass. (Bath), Trans. Sect. C, pp. 659-660.

⁵ Proc. Bristol Nat. Soc., n.s., Vol. V, pp. 31-45.

⁶ Ibid., Vol. IV, pp. 171-197.

of Portishead'¹ (1885), 'Bristol Building Stones'² (1886), 'The Mendips, a Geological Reverie'³ (1887).

Mr. S. S. Buckman's far-reaching work on the geology and palaeontology of the Jurassic rocks of the South-West of England, began during this period. His papers on 'Some species of Brachiopods from the Inferior Oolite of the Cotteswolds'⁴ (1886), 'On the Cotteswold, Midford and Yeovil Sands'⁵ (1889), and 'On the Relations of Dundry with the Dorset, Somerset and Cotteswold areas'⁶ belong to this decade. E. Witchell and W. C. Lucy were also at this time active workers on the Oolite rocks of the Cotteswolds.

Allusion must be made to two important papers on fossil fish by J. W. Davis, viz., 'On the Fish Remains of the Bone Bed at Aust near Bristol'⁷ (1881), and 'On the fossil fish of the Carboniferous Limestone of Great Britain'⁸ (1883). A very large proportion of the teeth and spines figured in the 65 plates accompanying this memoir come from the Avon quarries.

1890-1899.

The chief papers published during this decade were by workers who were already active during the preceding one.

H. B. Woodward's long study of the Jurassic rocks culminated in the publication in 1893 of his Memoir on the Lias of England and Wales, and in 1894 of the companion volume on the Lower Oolitic Rocks of England. Both these memoirs are all important to Bristol geologists. Much other valuable work on the Jurassic and Rhaetic rocks of the district was done by Edward Wilson and Mr. S. S. Buckman who were joint authors in 1896 of a paper on 'Dundry Hill, its upper portion, or the beds marked as Inferior Oolite in the map of the Geological Survey'⁹; Mr. Buckman's paper on 'The Bajocian of the Mid-Cotteswold'¹⁰ (1895) in which the remarkable non-sequential succession of the oolitic rocks was described and shown to be due to contemporaneous erosion, belongs to this decade, as also a paper on 'The Bajocian of the Sherborne District'¹¹ (1893); this paper contains a comparison with the rocks of Dundry. E. Wilson's careful account

¹ Proc. Bristol Nat. Soc., n.s., Vol. V, pp. 17-30.

² Ibid. Vol. V, pp. 95-115.

³ Ibid. Vol. V, pp. 236-260.

⁴ Proc. Cotteswold Nat. Field Club, Vol. IX, pp. 38-43.

⁵ Q.J.G.S., Vol. XLV, pp. 440-474.

⁶ Proc. Cotteswold Nat. Field Club, Vol. IX, pp. 374-387.

⁷ Q.J.G.S., Vol. XXXVII, pp. 414-426.

⁸ Sci. Trans. Roy. Dublin Soc., Vol. I, ser. 2, pp. 301-600.

⁹ Q.J.G.S., Vol. LII, pp. 669-720.

¹⁰ Ibid. Vol. LI, pp. 388-462.

¹¹ Ibid. Vol. XLIX, pp. 479-522.

of the Rhaetic section at Pylle Hill, Totterdown,¹ was published in 1891. Wilson also during this period published valuable lists of the fossil types in the Bristol Museum² (1890), and in the Bath Museum³ (1892), and in collaboration with W. H. Hudleston their 'Catalogue of British Jurassic Gasteropoda' (1892). The preparation of this Catalogue which includes 147 pages must have involved an immense amount of labour.

Considerable attention was paid during this decade to the question of the origin of the well-known Cotham or Landscape Marble, this being the subject of papers by B. Thompson⁴ (1894), and H. B. Woodward⁵ (1892 and 1898).

Mr. E. B. Wethered continued his study of the lithology of the local sedimentary rocks, his papers 'On the occurrence of the genus *Girvanella* in oolitic rocks . . .'⁶ (1890), 'On the Inferior Oolite of the Cotteswold Hills with special reference to its microscopical structure'⁷ (1891), and 'On the formation of Oolite'⁸ (1895) all deal with the question of the origin of oolitic structure.

The meeting of the British Association at Bristol in 1898 was directly responsible for two most valuable comprehensive accounts of Bristol geology, Mr. W. H. Hudleston's presidential address to Section C, and Prof. Lloyd Morgan's 'Geological History of the Neighbourhood of Bristol,' published in the British Association Handbook. Mr. Hudleston's address is mainly a critical account of the advances in the study of local geology since the previous meeting of the British Association at Bristol in 1875, and the publication of the Survey Memoir on the district in 1876. Prof. Lloyd Morgan's admirably concise and graphically written chapter has been the foundation on which all subsequent accounts of local geology have been based.

1900-1912.

During the latter part of the preceding decade E. Wilson had been engaged with the aid of a grant from the British Association on the study of a bone-cave at Uphill. This work was continued by his successor as Curator of the Museum, Mr. H. Bolton.⁹ Apart from work at Uphill, not much has been done during recent times in the study of the Bone-Caves of the Bristol district, but Mr.

¹ Q.J.G.S., Vol. XLVII, pp. 545-549.

² Geol. Mag., n.s., Dec. 3, Vol. VII, pp. 363-372, and 411-416.

³ Proc. Bath Nat. Hist. and Antiq. Field Club, Vol. VII, No. 3, pp. 270-292.

⁴ Q.J.G.S., Vol. L, pp. 393-410.

⁵ Geol. Mag., n.s., Dec. 3, Vol. IX, pp. 110-114; Rep. Brit. Ass. (Bristol) Trans. Sect. C., p. 869.

⁶ Q.J.G.S., Vol. XLVI, pp. 270-283.

⁷ Ibid. Vol. XLVII, pp. 550-570.

⁸ Ibid. Vol. LI, pp. 196-209.

⁹ Rep. Brit. Ass. (Bradford), 1900, *Reports of Committees*, pp. 342-343, and Ibid. (Glasgow) 1901, p. 352.

H. N. Davies described a human skeleton from Gough's Cave, Cheddar¹ (1904) and a small Bone-Cave at Walton near Clevedon was described by him² and by the present writer³ in 1907.

Although the Rhaetic rocks are very widespread and well developed in the Bristol district, they are as a rule only rarely and temporarily well-exposed. Consequently any new sections are of special interest. Such sections were described at Redland by Mr. W. H. Wickes⁴ (1900) and at Emborough by Prof. Lloyd Morgan and the present writer⁵ (1900).

The construction by the Great Western Railway Company of the South Wales direct line from Wootton Bassett through Chipping Sodbury to Filton, which was in progress during the last years of the 19th and the beginning of the present century, provided a splendid section of almost the whole stratigraphical succession from the Old Red Sandstone to the Corallian. Brief accounts of the exposures were given by Messrs. H. B. Woodward and A. Strahan⁶ in 1899, 1902, and 1903, while Dr. A. Vaughan and the present writer described the Jurassic rocks⁷ in 1902 and the Rhaetic rocks⁸ in 1904. Mr. (now Dr.) A. R. Short⁹ (1904) also described several Rhaetic sections in the Bristol district, including those of the South Wales direct line, and in 1903¹⁰ reverted to a subject which had already been considered by H. B. Woodward and by B. Thompson—the origin of the Cotham Marble.

During this period too, several new theories were brought forward to explain the peculiar Rhaetic Bone-bed, which is so characteristic of the Bristol district, and is well seen at Aust. Mr. Short (op. cit. 1904) considered it was formed during a stormy period after the sea had made its first irruption into the dried up or silted up level surface of the Keuper lake. Mr. W. H. Wickes¹¹ (1904) ably worked out an ingenious theory attributing the Bone-bed to the accumulation of the remains of migratory shoals of fish and of the reptiles which preyed on them, while Mr. L. Richardson¹² maintained that the Bone-beds were simply accumu-

¹ Q.J.G.S., Vol. LX, pp. 335-348.

² Proc. Bristol Nat. Soc., 4th Ser., Vol. I, pp. 188-189.

³ Ibid. pp. 183-187.

⁴ Ibid., n.s., Vol. IX, pp. 99-103, and Proc. Geol. Ass., Vol. XVI, pp. 421-423.

⁵ Proc. Bristol Nat. Soc., n.s., Vol. IX, pp. 109-117.

⁶ Summary of Progress of Geol. Surv. for 1898, pp. 188-194; Ibid. for 1901, pp. 59-60; Ibid. for 1903, pp. 171-173.

⁷ Q.J.G.S., Vol. LVIII, pp. 719-752.

⁸ Ibid. Vol. LX, pp. 194-214.

⁹ Ibid. Vol. LX, pp. 170-193.

¹⁰ Proc. Bristol Nat. Soc., n.s., Vol. X., pp. 135-149.

¹¹ Ibid. pp. 213-227.

¹² 'Geology in the Field,' p. 333.

lations formed during periods of slow sedimentation, and did not require any special theory for their explanation. A sequel to Mr. Wickes' paper on the Rhaetic Bone-bed was that on 'Pebble-swallowing Animals'¹ (1908).

Mr. Richardson has described the Rhaetic Rocks of the South and West of England in a long series of papers. The field of some of these lies outside our area, but attention may be drawn to the following: 'Notes on the Rhaetic Rocks round Charfield'² (1904), 'The evidence for a non-sequence between the Keuper and Rhaetic Series of North-West Gloucestershire'³ (1904), 'The Rhaetic and Contiguous Deposits of West, Mid, and part of East Somerset'⁴ (1911).

It is impossible to allude to more than a fraction of the papers on the Jurassic Rocks which Mr. Richardson has published in the Proceedings of the Cotteswold Naturalists' Field Club and elsewhere. They include 'On the Inferior Oolite and contiguous deposits of the Bath-Douling District'⁵ (1907), 'On the top beds of the Inferior Oolite at Rodborough Hill, Stroud'⁶ (1907), 'On the section of Lower Lias at Hock Crib, Fretherne'⁷ (1908), 'On the Inferior Oolite and contiguous deposits of the South Cotteswolds'⁸ (1910). Mr. Richardson either alone or in association with Mr. E. T. Paris, has also contributed several papers on the palæontology of the Jurassic rocks of the South-West of England.

Dr. A. Vaughan in collaboration with Mr. J. W. Tutchter described the Lower Lias of Keynsham⁹ (1902), while Mr. Tutchter summarized the information available on the subject in his paper on 'The Lower Oolites near Bristol'¹⁰ in 1903, and described the Liassic and Rhaetic Rocks of the Filton and Avonmouth railway¹¹ in 1908. The rocks of the Great Western branch line from Camerton to Limpley Stoke were described by Mr. H. B. Woodward in 1908,¹² by Mr. Winwood in 1908,¹³ and by Mr. Richardson¹⁴ in 1909.

¹ Proc. Bristol Nat. Soc., 4th ser., Vol. II, pp. 5-21.

² Geol. Mag., n.s., Dec. 5, Vol. I, pp. 532-535.

³ Q.J.G.S., Vol. LX, pp. 349-358.

⁴ Ibid. Vol. LXVII, pp. 342-392.

⁵ Ibid. vol. LXIII, pp. 383-436.

⁶ Proc. Cotteswold Nat. Field Club, Vol. XVI, pp. 71-80.

⁷ Ibid. Vol. XVI, pp. 135-142.

⁸ Ibid. Vol. XVII, pp. 63-136.

⁹ Proc. Bristol Nat. Soc., n.s., Vol. X, pp. 3-55.

¹⁰ Ibid. pp. 150-168.

¹¹ Ibid. 4th ser., Vol. II, pp. 5-21.

¹² Sum. of Progress of Geol. Surv. for 1907, pp. 155-157.

¹³ Proc. Bath and Dist. Branch of the Somerset Arch. and Nat. Hist. Soc. (1908), pp. 195-197.

¹⁴ Proc. Geol. Ass., Vol. XXI, pp. 97-100.

Mr. Richardson's chapter on the Neozoic rocks of Gloucestershire and Somerset, published in 'Geology in the Field,' the Jubilee volume of the Geologists' Association (1910) gives a general account of these rocks. Allusion may here be made to the corresponding chapter on the Palæozoic rocks contributed by the present writer, and to the 'Sketch of the Geological History of the Bristol District'¹ by Prof. Lloyd Morgan and him (1909), which brings up to date Prof. Lloyd Morgan's account prepared for the British Association meeting at Bristol in 1898.

There can be no doubt that the most important paper published during this period on local geology was that by Dr. Vaughan on 'The Palæontological Sequence of the Carboniferous Limestone of the Bristol Area'² (1905). If one may judge by the stimulus which this paper has afforded to research on the Carboniferous Limestone, and the wide applicability of its results not only throughout the British Isles but also on the Continent, no more important stratigraphical paper has been published since those by Prof. Lapworth on the correlation of the lower Palæozoic rocks by means of graptolites. This paper has rendered the Avon Section the typical one with which all other Carboniferous Limestone sections in Western Europe are correlated, and leads year by year to the visit of geologists, singly or in parties, to study these exposures. This study was rendered easier by the publication in 1906 in the Bristol Naturalists' Society's Proceedings of Dr. Vaughan's paper on 'The Avonian of the Avon Gorge'³ illustrated by a series of text figures of fossils, and by fifteen collotype plates of the cuttings and quarries on both sides of the river.

Dr. Vaughan's work has been ably carried on and applied by Dr. (now Professor) T. F. Sibly in his papers on the Carboniferous Limestone of Burrington Combe⁴ and of the Weston-super-Mare District⁵ (1905) and of the Mendip Area⁶ (1906).

Other papers dealing with the local Carboniferous Limestone fossils are that by Dr. Vaughan 'On the Corals and Brachiopods from the Avon Section preserved in the Stoddart Collection'⁷ (1903) and those by Mr. R. G. Carruthers on Carboniferous Corals⁸ (1908).

The slight but interesting manifestations of volcanic activity in the Carboniferous Limestone rocks of North Somerset attracted a good deal of attention during this period. The first general account was given by Sir A. Geikie and Mr. A. Strahan⁹ (1899)

¹ Proc. Bristol Nat. Soc., 4th ser., Vol. II, pp. 5-26.

² Q.J.G.S., Vol. LXI, pp. 181-307.

³ Proc. Bristol Nat. Soc., 4th ser., Vol. I, pp. 74-168.

⁴ Ibid. pp. 14-41.

⁵ Q.J.G.S., Vol. LXI, pp. 548-563.

⁶ Ibid. Vol. LXII, pp. 324-380.

⁷ Proc. Bristol Nat. Soc., n.s., Vol. X, pp. 90-134.

⁸ Geol. Mag., n.s., Dec. 5, Vol. V, pp. 20-31, 63-74, 158-171.

⁹ Summary of Progress of Geol. Surv. for 1898, pp. 104-111.

and these rocks were subsequently more fully described by Prof. Lloyd Morgan and the present writer¹ (1904). Prof. W. S. Boulton² added a number of observations on the section at Spring Cove near Weston-super-Mare (1904), and the field observations from various sources were collected together in a paper published in 1904 in the Bristol Naturalists' Society's Proceedings.³

The Upper Carboniferous rocks (Coal Measures, etc.) in spite of their great economic importance, have been relatively little described, but Mr. H. Bolton recorded a marine fauna in the lower Coal Measures of the Bristol area in 1907⁴ adding further details in 1911.⁵

A considerable amount of attention has been devoted to the oldest rocks of the Bristol area, the Silurian, which occur in the Tortworth district and in the Eastern Mendips to the north of Shepton Mallet. The existence of rocks of this date, in the latter area was first recognized by the present writer in 1907.⁶ At both these localities the Silurian rocks are noticeable from the fact that they are associated with contemporaneous volcanic rocks, such rocks of Silurian age being almost unknown elsewhere in the British Isles. The Tortworth Silurian rocks were described in two papers by Prof. Lloyd Morgan (1901)⁷ and by Dr. F. R. C. Reed⁸ (1908) in each case in collaboration with the present writer. Further information on the Silurian rocks of the district is contained in the reports of a committee of the British Association appointed for their investigation (Dublin, 1908, Portsmouth, 1911).

¹ Q.J.G.S., Vol. LX, pp. 137-157.

² Ibid. pp. 158-169.

³ Proc. Bristol Nat. Soc., n.s., Vol. X, pp. 188-212.

⁴ Q.J.G.S., Vol. LXIII, pp. 445-469.

⁵ Ibid. Vol. LXVII, pp. 316-341.

⁶ Ibid. Vol. LXIII, pp. 217-240.

⁷ Ibid. Vol. LVII, pp. 267-284.

⁸ Ibid. Vol. LXIV, pp. 512-545.

Account of the General Meetings and the Annual Meeting of the Society from January 16th, 1913. to December 6th, 1913.

The following account of the various meetings has been compiled by the Secretary, but most of the reports of the meetings are due to the Reporting Secretary, Mr. J. Kemp, whose reports to the daily papers thus obtain a more permanent place. There are but few alterations as compared with the form in which the reports were sent to the *Western Daily Press* and the *Times and Mirror*.

THE 50th ANNUAL MEETING.

January 16th, 1913.

(*Western Daily Press*, Jan. 17th, 1913).

"The 50th annual meeting of the Bristol Naturalists' Society was held in one of the lecture rooms of the University, on Thursday evening. The Reports of the Secretary, Treasurer and Librarian for the year were read, after which the officers and Council for the new year were elected by ballot. There was no opposition to the names on the balloting list, which were as follows:—President: Miss Ida M. Roper, F.L.S. Vice-Presidents: Mr. G. C. Griffiths, F.Z.S., F.E.S., Professor Reynolds, M.A., F.G.S., Mr. C. Bartlett, and Mr. C. Fortey. Treasurer: Mr. W. A. Smith, M.B. Secretary: Dr. O. V. Darbishire. Reporting Secretary: Mr. J. T. Kemp. Librarian: Mr. A. B. Prowse, M.D., F.R.C.S. Sub-Librarian: Miss Ida M. Roper, F.L.S. Council: Messrs. F. Beames, B.Sc., E. H. Cook, D.Sc., H. Gummer, C. J. Hodgson, J. Rafter, M.A., Miss Reynolds, D. W. Stanton, R. B. Webb, and W. H. Wickes.

"After the election Dr. G. Munro Smith, the retiring President, resigned the chair to Miss Roper, the first lady to hold the presidential office in the history of the Society. Miss Roper thanked the Society for the honour conferred on her.

"Dr. G. Munro Smith then delivered the annual address, in which he spoke of various unscientific and therefore misleading ways in which natural history subjects were often treated by writers on them."

[N.B.—Dr. Smith's annual address is printed in full in the last number of the Proceedings.]

THE 432nd GENERAL MEETING OF THE SOCIETY.

February 6th, 1913.

(Bristol Times and Mirror, February 10th, 1913.)

"A meeting of the Bristol Naturalists' Society was held at the University, Miss Roper presiding, when the following ladies and gentlemen were admitted as members or associates: Miss Ball, Mrs. Ulrich Just, Miss Alice Randall, Mr. J. Herbert, and Mr. A. W. Cottle. The President exhibited some twigs of willow just coming into bloom, which were gathered from bushes on the waste ground now exposed to view between St. Augustine's Bank and Host Street. Probably a spring exists there. Miss K. I. Williams read a paper, which was listened to with great interest, on "Fish and vegetable foods as served at table," in which she gave results of work carried out by herself in the University. Miss Williams' work, as described in her paper, concerns cooked fish and vegetables. Most foods have a percentage destitute of value as food, e.g., the shells of eggs and the skin of potatoes. Changes produced in cooking were then described. For example, rice is often boiled with more water than it can absorb, consequently the water which takes out the protein and mineral matters is thrown away. Rice is, in fact, much more nourishing when cooked without draining. The theory that fish is an excellent brain food, on account of the phosphorus it contains, was shown to be erroneous, as the amount of that element is extremely small. Fish can only be considered a wholesome food when fresh, but should be avoided when served with sauces to conceal its stale odour, as is often done on the Continent. In potatoes the valuable salts exist close to the skin, being lost in peeling. To get the proper supply of different nutrients required by the human body mixed rations are needed; milk is one of the few foods which supply them all. At the conclusion of her paper Miss Williams exhibited slides showing the percentage composition of various foods, chiefly vegetables. A discussion followed on various points raised by Miss Williams' paper."

433rd GENERAL MEETING OF THE SOCIETY.

March 6th, 1913.

(Western Daily Press, March 11th, 1913.)

"At the last meeting of the Society Miss Roper, F.L.S. (the President), announced the election of Mr. O. J. Mountney, Mrs. Sandwith, and Col. Couchman as ordinary members, and Mr. Mockeridge, Miss Mullock, and Miss Winn as associates. A

circular letter from the President and Hon. Secretary on the occasion of the Jubilee of the Society states that it is felt that this event should be celebrated by a united effort to extend the usefulness of the Society by increasing its membership. So long a period of existence tells of the hold that natural history has upon successive generations, and certainly with the extensive facilities for travel and observation we now possess this interest should not diminish at the present time. The Bristol Naturalists' Society meets frequently for lectures, for papers on various subjects, and for the discussion of exhibits; and sections have been formed for the special study of geology, entomology, and botany, under the direction of competent leaders. Occasional excursions are organised in the summer months. The Society's Natural History Library is one of the best in the kingdom. It is housed in a suitable room in Berkeley Square, where members may read in comfort, or the books may be taken away under certain conditions.

"The President showed specimens of a moss (*Leucobryum glaucum*) which usually grows on the ground, but pieces of which, becoming detached, flourish independently, and take the shape of balls, which are blown about by the wind. Mr. Griffiths showed specimens of the chrysalis of the orange-tip butterfly (*Anthocharis Cardamines*), which mimic the stems of the cuckoo flower on which the caterpillar feeds, also specimens of the foreign relations of the perfect insect. Mr. White, F.L.S., exhibited specimens of the yellow gagea (*Gagea lutea*), a rare British plant flowering three weeks earlier than usual.

"Dr. C. K. Rudge then gave an interesting lecture on 'Food of animals, and the stratagems employed in obtaining it.' He began by defining the terms 'food' and 'animal,' pointing out that by the former is meant anything which is taken into the system to maintain life and growth and to repair waste, and showing the connection of the latter with the Latin word 'anima' or breath, and as denoting a member of the higher of the two groups of living beings. The old Scotch writer, Gavin Douglas, included under the term mankind, beasts, birds, fishes, and serpents, *i.e.*, not only four-footed beasts to which the term is often restricted. The amount of food consumed and the frequency of feeding vary within wide limits. Mr. Woodward, the superintendent of the Clifton Zoological Gardens, had supplied the lecturer with the following data of the food taken daily by some of the animals:

"Lions and tigers, 10-12 lbs. animal food.

"Leopards, 5-6 lbs. animal food.

"Elephants, 1 cwt. of hay and $\frac{1}{2}$ cwt. of roots, &c.

"Camels, $\frac{1}{2}$ cwt. of hay.

"Llamas, 6 lbs. of hay and a small quantity of roots.

"With regard to bears it was stated that for a period of seven or eight weeks, during which the mother is nursing her young,

she takes no food and drinks no water. Caterpillars consume vastly greater quantities of food in proportion to their size than other animals—in fact, as much as twice their own weight in leaves. This is as if one ox were to eat three-quarters of a ton of grass a day. Linnæus stated that three flies would eat a dead horse as quickly as a lion. This is true if the progeny share in the feast. Hewitt estimates that the offspring of a pair of flies, if none are destroyed, would occupy a space of a quarter of a million cubic feet in four months. The Lecturer pointed out the interdependence of birds and insects, and how impossible it would be for the former to exist in such vast numbers if it were not that the latter were so enormously prolific. Migration and hibernation are largely questions of food supply. Birds often travel long distances in search of food. Any day in Bristol rooks may be seen leaving their sleeping quarters in Ashton Park early in the morning and flying to Horfield and Almondsbury, whence they return in the evening. There are about 50 species of common British birds. Some are very prolific, and have three or four families during the breeding season. The number of insects required as food for the young is enormous. Professor Macgillivray noticed a thrush make 216 visits to the nest with food from 2.30 a.m. to 7 p.m., and a blue tit has been seen to make 475 journeys during a working day of 16 hours.

“Dr. A. E. Shipley, at a meeting of the British Association in 1909, estimated the number of species of animals then known at 790,533. Of these 13,800 are birds and 445,978 insects. It is birds which mainly keep down this vast insect life. From Professor Gathe’s observations in Heligoland we can realise what large numbers of migrants reach their feeding and breeding grounds just as insect life is waking up and plants are beginning to bloom, and the constant interaction which is going on between various forms of life. The Lecturer then gave an account of some of the means adopted by animals to secure their prey. Some hunt and stalk, others conceal themselves and leading a stationary life resort to lures and various devices, as the angler fish. Some again, as parasites, depend entirely on others, while some are commensals and live as fellow boarders. As one instance of the latter, the hermit crab and sea anemone were given. The latter lives on the shell which forms the crab’s house, and is thus carried about to fresh pasture grounds. The commensalism of the hermit crab and a worm, which lives in the brightest chamber of the whelk shell and slips down and helps itself when the crab is feeding, was also mentioned. Of all animals insects may be regarded as the most completely equipped for getting food from various sources, as they are able to extract it from such different things as succulent fruit and the leg of a chair or the case of a grandfather’s clock. According to Kirby 30 different species feed on the nettle alone, and as many as 200 on the oak. The Lecturer concluded by saying he had only touched on the fringe

of the subject, but insisted on its absorbing interest. The large literature which had lately sprung up with reference to the common house fly and its importance from a medical point of view, suggested that much remained to be done in other directions. The lecture was illustrated by a fine selection of lantern slides, and at the close a discussion took place and a hearty vote of thanks was given to the Lecturer."

434th GENERAL MEETING OF THE SOCIETY.

April 3rd, 1913.

(*Western Daily Press*, April 4th, 1913).

"A meeting of this Society was held at the University. The President (Miss Roper) announced the election, as ordinary members, of Dr. Marion Linton and Major T. D. Broughton, R.E.

"Dr. Prowse exhibited stick-insects that had lived on privet leaves for many months in his house. Specimens of the common Alexanders from St. Vincent's Rocks, badly infested by a peculiar fungus, were shown by the President; and Miss Reynolds brought implements of the Stone Age, with photographs of bone caverns visited by her in the Dordogne district.

"Mr. Cedric Bucknall then read a paper on 'Some Pre-historic Rock-figures,' illustrated by rubbings and drawings.

"The rock-figures in question are situated in the Italian Maritime Alps, at an elevation of from 6,600 to 7,600 feet, about the heads of four of five valleys, all lying directly underneath the crest of Monte Bego (8,900 feet). This region is approached from the south through the valley of the Roya, whence mule-tracks lead to the Vallone delle Meraviglie, the Val Malmasca, Val Valauretta, and Val Fontanalba; the nearest place of any importance being San Dalmazzo di Tenda, a summer resort on the Tenda-Turin route at about 2,300 feet. Prior to Mr. Bucknall's visit, so far as can be ascertained, only a very few Englishmen, at long intervals, have attempted to explore this interesting and beautiful district; and yet it is believed that there is no other place in Europe, or perhaps in the world, where such an immense surface of rock is covered with so many and so varied pre-historic engravings. It is to Mr. Clarence Bicknell, of Bordighera, who for fifteen years has passed the summer months in these mountain valleys, that a thorough investigation of these petroglyphs is due. During that period he has copied over 10,600 figures, and he thinks there may still remain from 500 to 1,000 more. The rocks upon which the figures have been cut are almost without exception of

the same nature—chlorate schist—with a hard, smooth surface, polished by attrition of the ice, and often with large areas free from cracks and fissures. The figures on them have been made by repeated blows of some pointed implement, probably of flint or other hard stone. No traces of metal have been found, and it has been proved by experiment that this kind of punching can be better executed by stone tools. Most of the figures represent horned animals—oxen, ibex, chamois, and sheep. There are some dogs and a bird or two. The oxen are often in pairs, and rude indications of a plough and a man. Other designs consist of weapons, geometrical figures, and complicated patterns of doubtful meaning. Their age has been computed at from 3,000 to 3,500 years, and the artists were probably herdsmen of African origin, who had been engaged in the chase and in agriculture before ascending to the Ligurian Alps.”

(N.B.—A full account of this paper was published in the last number of the Proceedings).

435th GENERAL MEETING OF THE SOCIETY.

May 1st, 1913.

(*Western Daily Press*, May 7th, 1913).

“The last general meeting of the session was held at the University. Miss Ida M. Roper, President, was in the chair. Mr. O. J. Mountney showed some shells of the Roman snail (*Helix pomatia*), found frequently on the sites of Roman villas and camps. He had recently discovered a living specimen. Mr. Denys Munro Smith showed some interesting lantern slides from photographs of the nests of local birds, including the sheld-duck, shoveller, wild-duck, curlew, circl bunting, reed-warbler, willow-wren, chiff-chaff, wood-wren and lapwing, &c.; also a photograph of a young cuckoo in the nest of sedge-warblers, its foster-parents. The nest of the sheld-duck photographed was made on the ground, a very unusual position, the bird generally selecting a rabbit-burrow or hollow tree for its eggs. Several nests of the circl-bunting had been found, the bird being fairly abundant in the district and nesting not far from the city. The lecturer commented on the lapwing’s habit of hovering and screaming over the intruder’s head. This was never done near the eggs. A curious trick of the willow wren of descending on her nest containing eggs, from which she has been disturbed, with grass in her bill, was mentioned. This had also been noticed in the case of a blue-tit. The frequently described habit, common to many species of birds, of fluttering about as if wounded, when put off their young was discussed.”

THE JUBILEE RECEPTION OF THE BRISTOL
NATURALISTS' SOCIETY BY THE LORD MAYOR
IN THE MUSEUM AND ART GALLERY,
ON MAY 8th, 1913.

(Western Daily Press, May 9th, 1913).

In celebration of the Jubilee of the Bristol Naturalists' Society, a reception by the Lord Mayor (Alderman C. J. Lowe), the Lady Mayoress (Miss Lowe), and the President of the Society (Miss Ida M. Roper), was given last night at the Municipal Museum. The occasion was one which lent itself to interesting retrospect; the building in which the guests spent the evening—the natural history part of the Museum—contains much to occupy naturalist visitors, and an attractive programme had been arranged by those responsible for the gathering. Guests entering from University Road were received by their hosts and tea and coffee served in the vestibule, music being provided by the Strad Orchestra. Shortly before nine o'clock the company assembled in the Lecture Theatre and several short speeches were delivered. Besides the Lord Mayor and Lady Mayoress, and the President of the Society, invitations were accepted by the Sheriff and Mrs. Lennard, Sir Isambard Owen and Lady Owen, Aldermen Fuller Eberle, J. Boyd, and other members of the Museum Committee, Dr. Lloyd Morgan, Prof. S. H. Reynolds, Prof. F. Francis, Prof. J. Michell Clarke, Prof. E. Fawcett, Prof. Stanley Kent, Dr. J. E. King, Dr. Cyril Norwood, Colonel Cary-Batten, Dr. W. E. Hoyle (Director of the National Museum of Wales), the Rev. W. Butt (President of the Cotteswold Field Club), Mr. Upfield Green (London), Dr. E. H. Cook, Dr. Prowse, Mr. H. Bolton (Director of Bristol Museum), Mr. C. K. Rudge, Dr. G. Munro Smith, Dr. Rose, Dr. Cyril Walker, and others. Letters regretting absence but conveying cordial wishes for the success of the Bristol Naturalists were read from the following past members of the Society: Sir William Ramsay, Sir W. A. Tilden, Prof. Sydney Young, and Prof. J. H. Priestley.

FEATURES OF THE PAST HALF CENTURY.

"After a few preliminary remarks by the Lord Mayor, the President of the Bristol Naturalists' Society (Miss Roper, F.L.S.) made some interesting references to the history of the organisation. She said it was her pleasing duty on behalf of the members of the Bristol Naturalists' Society to return their best thanks to the Lord Mayor and the Museum Committee for the kind words and cordial welcome extended to them. They were associated at least by the common interests in Natural History, and it was always very gratifying to meet with helpful co-operation, especially from a body like the Corporation of

Bristol. Amongst the most pleasant events connected with the Society was the honour of being received in that splendid Natural History Museum as the guests of the city. They owed this to the desire to encourage the Society's pursuits and to the fact that to-day the Bristol Naturalists' Society completed fifty years of its existence, for it was founded on Thursday, May 8th, 1862. It was a long period of usefulness, and members might be proud of its success. The father of the Society was Adolph Leipner, still well remembered for his genial enthusiasm and varied knowledge. To his constant care, which only ceased at his death, the Society owed much in its early days, and although he has a memorial at the Bristol University erected by his fellow members, it was a pleasure on that occasion to again testify to their appreciation of his labours. With even greater pride they could look back on the excellency of the work done and at the names of those connected with the Society. Amongst those active workers no longer living who gave of their best, and whose reputation extended over the kingdom, were Dr. Herapath: William Sanders, who worked out the geological map of the Bristol Coal-fields, and so set up the boundaries of our local labours: W. Lant Carpenter, the social reformer: Dr. John Beddoe, the authority on the races of mankind: and Dr. Hudson, who illustrated much of his work in pond life by examples gathered locally. When the Bristol University College was started it was natural they should be indebted for a proportion of the papers read at their meetings to those members who were professed students or teachers of science. And here the names were numerous that had become celebrated in wider spheres. To mention a few the Society was helped by Prof. Sylvanus Thompson on physical experiments; by Prof. W. J. Sollas, on geology; by Sir William Ramsay, on properties of the elements; by Sir William Tilden, on chemistry; and not the least by Dr. Lloyd Morgan. Yet amidst all these they found standing out prominently the splendid work of local amateurs in Natural History. They knew the value of such observations and experiences, and freely gave them to the Society, and to some of them they owed immense encouragement and help. She might specially mention, in the order of their works, Mr. Alfred E. Hudd, for the local list of Lepidoptera; Mr. Cedric Bucknall, for the list of fungi; Mr. J. W. White, for list of flowering plants; Mr. H. J. Charbonnier, for mammals and fish, and later for diptera; Mr. C. K. Rudge, of fish; and Mr. H. C. Playne, of birds. With the exception of the last-named gentleman, they are all still members, showing that the love of Nature, once cultivated, leaves one only with life. The Society, too, might be proud that with the lapse of fifty years so many of the earliest members had remained full of interest in its welfare, and some of them were with them that evening to help celebrate their jubilee. And now as to the permanent benefits to be derived from a gathering of naturalists like the present. What could they do for their pleasant pursuit—one that had always attracted learned

and gentle natures? Everyone who would could help in the cultivation of natural science, and could contribute results of value, whether for the sake of mental work or as an addition to knowledge. Let them therefore become more fully acquainted with those following the same studies; let them compare their successes and their deficiencies, and with cordial co-operation and generous help let them go forward to even greater success for the Society in the future.

THE CITY AND THE SOCIETY.

“Mr. H. Bolton said it was most fitting that the Natural History Society should celebrate its jubilee within those walls, because the Bristol Museum was largely concerned with the encouragement of natural history, and other cognate studies, and also represented the labours of an older institution, whose members worked upon broad lines which included natural history within their scope. This, the natural history side of the Museum, came into being as the result of the efforts of the old Literary and Philosophical Institution, and in seven years it would have completed, not fifty years of growth, but one hundred. The connection between the Museum and the Society ought to be a close one. Both were concerned with a developing love for, and a study of, Nature. Here they conserved the work of the older naturalists, and, as far as might be, added to the collections in the hope that the series as a whole would prove stimulative of outdoor study, and a love of animal and plant life. It was but fitting, he thought, on an occasion like that, that they should freely acknowledge their indebtedness to members of the Society. Former presidents, such as Professors Sollas, White, C. Lloyd Morgan, and Rudge, had added to or benefited the collections in some way, whilst the list of gifts from members would be a long one if it could be placed before them. Recent years had witnessed a revival of interest in the Museum, and this revival had been largely helped by the labour and gifts of Messrs. Charbonnier, Griffiths, Bartlett, Hudd, and Reynolds, and they all knew, as he knew, how much the Museum and the public had profited by the unselfish labour and botanical skill of their President, to whom they owed, year by year, the upkeep and perennial freshness of the flowering plants of the month. To their Lady President they also owed the orderly arrangement of several of the large herbaria in the Museum, whilst her delightful optimism and energy reacted upon the staff with good results to them all. But of the general body of members they did not see as much as they would wish, and he doubted if they were fully alive to the opportunities of assistance in their studies which were furnished by the collections. Could not this be remedied? The flowers of the month were a useful guide to the botanist, the mollusca, and insect series equally helped the conchologist and entomologist, whilst the geologist would find much to direct his studies in the cases of the upper room, and other sections would, he believed, prove equally stimulating, and he could only trust that the demon-

stration which they would listen to would increase the interest in the Museum, and prove helpful to themselves. As representative in some measure of the Museum and those who govern its development, he cordially wished the Naturalists' Society long life, abundant and profitable labour, and great prosperity.

"Prof. Lloyd Morgan, in the absence of Sir Isambard Owen, said he was exceedingly sorry the Vice-Chancellor of the University was unable to be present. Those proceedings made him feel somewhat ancient, for he had been a member of the Society more than half of the fifty years. The early days of the Society were different days to the present days. It was easier fifty years ago to get the Society going than it was to-day. The causes were many and various, and he did not think they need enter into them that night. He thought, however, there were few societies in whose proceedings there was a greater body of really sound work which was worth appealing to by those who wished to know something about the district and what had been done in it. That occasion marked a step forward in the bringing together of the intellectual forces of Bristol. Those who represented the Society would join with him in congratulating the Committee and the Curator for the really admirable progress which had been made in the Museum and its work during the last few years. He hoped that might not be the last occasion upon which such a gathering would take place within those walls. It helped towards what was valuable, even in science—good fellowship.

"Dr. Hoyle, Director of the Welsh National Museum, in the course of an interesting speech, congratulated Miss Roper on her position, and Mr. Bolton on the progress which the Museum had made. He brought from the Cardiff Naturalist Society a resolution wishing the sister Society in Bristol every success, congratulating it upon attaining its jubilee, and hoping it would experience increased prosperity.

"Ald. J. Fuller Eberle (Chairman of the Bristol Art Gallery and Museum Committee) said his Committee welcomed them most heartily. One of their privileges was to enjoy seeing their fellow citizens take such an interest in that Museum. The Museum and Art Gallery were certainly an asset to Bristol. Visitors, as well as the citizens, were pleased with what was done at the Museum and Art Gallery. As a Committee they had to tender their warmest thanks to the Naturalists' Society for all that had been done and was being done in making such an interesting home in that building. They would do all they could to further and improve the Museum in every possible way. They had many delightful and valuable gifts, and they always had to remember that there were such things as rates. He moved a vote of thanks to the Lord Mayor, which was cordially carried.

"The remainder of the evening was spent in various departments of the magnificent Natural History Museum, to which Miss Roper

had referred in eulogistic terms. The building had not come into existence when the Bristol Naturalists' Society commenced its work, but the Bristol Institution in Park Street, founded at a much earlier date, served as a rallying point for those with scientific tastes, and many Bristolians can recall boyhood hours spent in examining its collection of exhibits. The removal to Queen's Road took place in 1871, but while a vast array of treasures was collected from various parts of the world, the institution was always handicapped by want of funds, and it was not until the late Sir Charles Wathen had cleared it of liability and handed it over to the city that the Museum began that development which has produced such excellent results under the enthusiastic superintendence of Mr. Bolton. It would now be a revelation to some of the older citizens who joined in the promotion of the Naturalists' Society, and whose ideas of a museum were based on the conditions with which they were familiar in their early life. In the Bristol Museum to-day the artist as well as the taxidermist plays an important part and the skill of the painter is able to supply a panoramic background, giving an idea of the habitat of the creature exhibited. Some of the cases now on view are fine examples of this combination of effort, but, great though the advance has been, it is scarcely a secret that the institution is badly in want of more room. There are hundreds of treasures never seen by the public because, literally, there is no space in which to display them. An excellent opportunity presents itself for private generosity, which has done much for the Museum, to supplement the efforts of the Civic Committee. Demonstrations were given in several of the departments of the Museum after the speech-making in the Lecture Theatre was over. In the Geological Room Dr. Lloyd Morgan dealt with 'Local Caves and their Ancient Inhabitants'; and he was followed by some comments by Professor S. H. Reynolds on 'Fossil Reptiles,' of which the section has a number of excellent examples. Mr. G. C. Griffiths discoursed on 'Butterflies,' in the Greville Smyth Room, and Dr. O. V. Darbishire on 'Seaweeds,' in the Dame Emily Smyth Room. In these instances also the rich array of exhibits of the Museum supplied a great variety of subjects."

THE SUMMER EXCURSION.

June 14th, 1913.

(*Western Daily Press*, June 17th, 1913).

"The summer excursion of the Bristol Naturalists' Society took place on Saturday afternoon, when a goodly number of members left Temple Meads station by the 1.33 train for Wrington, where they were joined by others who had travelled by bicycle or motor.

Leaving the village, the party, under the guidance of the President (Miss Roper), proceeded up the lane from Judge Jeffreys' Tree. Turning into the fields they reached the top of the hill overlooking Wrington, from which a magnificent view was obtained, including the Mendips, Crook's Peak, Brean Down, Worle Hill, the Steep and Flat Holms, the Quantocks, &c. A descent was then made to Barley Wood, celebrated as the residence of Hannah More, now owned by Mr. H. H. Wills, whose kind permission to explore the grounds was highly appreciated. On their way to the house the party noticed Mrs. More's memorial urn to her friend, Bishop Porteus, who died in 1808. Reaching the house, they were cordially greeted by Mrs. Wills. A short time having been spent in admiring the gardens, they sat down to an open-air tea, after which a vote of thanks to Mr. and Mrs. Wills was proposed by Miss Roper, and seconded by Dr. Prowse, to which Mr. Wills replied. The party was then conducted round the gardens by Mrs. Wills and her niece. The gardens are notable for their extent and the variety of their flowering plants. Returning to Wrington a visit was made to the fine parish church."

Mr. J. W. White has handed in the following account of the above excursion :—

The Members of our Society may well place among the most pleasant remembrances of their Jubilee year the successful excursion to Wrington and Barley Wood on the afternoon of June 14, when by the courtesy of Mr. and Mrs. H. H. Wills the beautiful grounds and gardens of their historic mansion, formerly the residence of Mrs. Hannah More, were placed at the Society's disposal. There was a full attendance, the day was lovely, and the district around Wrington was looking its best. In order that full use of the opportunity should be made, the visitors on arrival were induced by their President to make the ascent of West Hill, whence a most extensive view over the Vale, the Mendips, and the Bristol Channel, was obtained. The way thither lay past the ancient Gallows Tree at the cross roads, and through pastures gay with luxuriant crops of grass and wild flowers then ready for the scythe. On returning, the grounds of Barley Wood were reached by woodland paths that led to grateful shaded seats upon the lawns. A little later the party was warmly welcomed by Mr. and Mrs. Wills, and conducted to one of the rose-embowered terraces where tea had been provided in sumptuous fashion by the hospitable hosts. All this kindness was gratefully acknowledged by the President and Dr. Prowse who voiced the visitors' thanks for their reception and entertainment. Some portraits and other relics of the venerable lady who originally owned the property were viewed with interest, and then a charming hour flew quickly in the lower gardens and conservatories, ablaze with colour and admirably cared for. Amongst the more showy favourites of cultivation it was gratifying to see a place reserved for one or two of the rarer wild flowers of the neighbourhood: in particular,

several clumps of the Purple Gromwell (*Lithospermum purpureo-cæruleum*). At length the members found their way back to the village, and while some among them stood around the railed enclosure in the churchyard where lie the remains of Hannah More and her four sisters, others discussed the beauties of one of the most noteworthy of Somerset's admirable churches. It appears that Hannah More's occupation of Barley Wood came to an end in 1828, and the closing years of her life were passed elsewhere.

The knowledge that the excursion had been a brilliant success and worthy of the occasion may in some degree have recompensed our energetic and tactful President for the care and labour entailed in planning and carrying through such an expedition.

436th GENERAL MEETING OF THE SOCIETY.

October 2nd, 1913.

(*Times and Mirror*, October 4th, 1913).

"The first general meeting of the session of the Bristol Naturalists' Society was held in the Botanical Lecture Room of the University, Miss Roper presiding. The usual minutes having been read and approved, Dr. Darbishire (hon. secretary) moved for the second time certain alterations in the laws of the Society relating to the election of officers and Council. These were passed without opposition, and now come into effect without any further vote. Arrangements for the jubilee exhibition meeting on November 6th were then discussed. It was decided to hold it in the large hall of the University, the use of which has been kindly granted for the occasion without charge. The exhibition will not be confined to members of the Society, but non-members wishing to exhibit must be introduced by a member. Scientific exhibits relating to the Bristol district are specially desired.

"The following exhibits were made by members :—Life history of the Vapourer moth (*Orgyia antiqua*), including two species of parasites by Mr. W. A. Smallcombe; living bacteria from a pond in the University garden, by Dr. Darbishire; the upright sea lavender (*Limonium binervosum*) gathered between Clevedon and Weston by the President.

"Mr. W. A. Smallcombe gave a most interesting account of his observations in various species of ants found in Somerset and Gloucestershire, illustrated by lantern slides. He has met with ten out of the forty known British species, and has studied their ways and life history both in their natural habitats and in captivity with great care and accuracy. Living colonies of most

of them were shown, with a complete set of the ten local species preserved and mounted."

(N.B.—A full account of this paper will be found in the present number of the Proceedings.)

437th GENERAL MEETING OF THE SOCIETY.

Nov. 6th, 1913.

(*Times and Mirror*, Nov. 7th, 1913).

"The second general meeting of the session of the Bristol Naturalists' Society was held last evening in the large Hall of the Bristol University, and in conjunction with it was an exhibition illustrating the fauna, flora, and geology of the Bristol district, some particulars of which were given in our issue yesterday. The exhibition was quite a remarkable one for so small a society, and showed the keen interest which the members take in their work. The various specimens were admirably prepared, and were staged so as to be seen to the best advantage. The exhibition was so successful that it is likely to be made an annual fixture. There was a large company present, and a thoroughly interesting and enjoyable evening was spent by them.

"At the meeting, Miss Ida M. Roper, the President of the Society, presided, and said she was pleased to see so many of the members and their friends present, and to learn that so many members were exhibitors. The getting up of that exhibition was almost entirely due to the energy and labour of Dr. Darbishire.

"Dr. Darbishire said that they would all remember their first meeting of the season, last January, was their 50th annual meeting, and when they discovered that, they thought it would be suitable to have one or two special meetings during the year. Their first special meeting was a social function—a reception by the Lord Mayor in the Museum, and the second was an excursion. The exhibition that evening was for the members and their friends, and was a sort of family gathering where they had an opportunity of bringing specimens and showing them to their friends and discussing them. In that way they hoped to bring together those interested in natural history and encouraging those not yet interested in it to become naturalists. And, from what he could see of the large number of exhibits and persons present, their efforts had been well rewarded. The meeting had been made possible largely through the University authorities giving them that hall free that evening. The specimens shown were meant to represent, more or less, the Bristol district. It was intended to hold this type of meeting not only this year, their jubilee year, but every year, when specimens would be included from all parts of

the world. Their members were increasing so rapidly that probably next year that hall would not be big enough.

"Prof. S. H. Reynolds then gave an address on his own exhibit, which consisted of geological specimens of the Avon Gorge. He said that the Avon Gorge was the most interesting scientific feature they had in the Bristol district. Its interest was twofold. There was the scenic interest, and how it was formed was a puzzle to many people. Dr. Lloyd Morgan had given them a very clear account of the probable way in which the Gorge was formed. The point with which he was concerned was that afforded by the magnificent section of carboniferous rocks. Since Dr. Vaughan's book their Avon section had become the typical section, not only for the British Isles but for the whole of Europe. One of the most important geological discoveries at the end of the last century was that strata were recognisable by the particular fossils they contained. This was further elaborated, so that now the rocks were divided up into five zones. The Avon quarries were not all limestone, but included rocks of other kinds. These were deposited in varying conditions, and by examining the character of the rocks they could get a good idea of the conditions and time under which they were deposited. His remarks were illustrated by some beautiful lantern slides, intended to illustrate the scenery and show the character of the rocks."

438th GENERAL MEETING OF THE SOCIETY.

December 4th, 1913.

(*Times and Mirror*, Dec. 6th, 1913).

"A meeting of more than usual interest was held in the Chemical Lecture Theatre of the University on Thursday night, Miss Roper presiding, when a lecture illustrated with lantern views, was given by Dr. W. E. Hoyle, of Cardiff, on "Folk Museums." Formal business of the Society, including the nomination of candidates for offices and Council during the ensuing year occupied the first part of the evening. The nominations are subject to confirmation in January. Mr. G. C. Griffiths, F.Z.S., exhibited a copy of a French work on lepidoptera, with notes and drawings added by the late Dr. A. R. Wallace, to whom it formerly belonged; also a butterfly captured by that naturalist in 1859.

"Dr. Hoyle began his lecture by defining a museum as an institution for the preservation of objects of nature or works of man, and their utilisation for the education, enlightenment, and pleasure of the people in various ways. A folk museum, which is the English equivalent of a name first given in Germany, he defined as a museum of the people for the people. Its object was

to set forth the social life in all its aspects, housing, clothing, occupation of a nation or class of people from its earliest times. It should illustrate the different aspects of a nation's life. The pictures which followed were chosen to illustrate different types of folk museums. The first was the National Museum of Bavaria at Munich, with its 100 exhibition rooms designed and decorated to illustrate the different periods to which their contents respectively belong. New York has a Children's Museum of objects of nature and art in which children are interested arranged for their instruction, together with a reference library relating thereto. At Copenhagen is the Danish Folk Museum, illustrating the domestic life of the nation, and especially of the peasantry. It includes peasants' houses and farm buildings which have been removed from other sites. Stockholm possesses a folk museum on the grandest scale, with peasants' houses in which the museum attendants live wearing different types of native costume. In conclusion Dr. Hoyle urged the importance of collecting articles of all kinds which are now rapidly passing out of use, and keeping records of the way in which they were used. He considered the Crystal Palace an ideal site for an English Folk Museum worthy of our past and a stimulus for the future.

"A vote of thanks to Dr. Hoyle was proposed by Dr. Munro Smith and seconded by Professor Leonard, who expressed the wish that an old English village could be acquired and preserved in its entirety, with its church, and also chapel; also its stocks, in which visitors who littered paper about might be confined, while a pillory might be erected for those who leave broken bottles. Dr. Rudge mentioned ancient houses at Conway and Norwich in which beginnings had been made of folk museums."

Botanical Notes.

BY JAS. W. WHITE, F.L.S.

THE *Flora of Bristol* is receiving additions year by year. For 1913, the notes of most importance run as follows:—

Stellaria palustris Retz. A good additional locality (the plant occurring over a space of 40 yards) was found on Nailsea Moor by Miss Roper and F. Samson.

Astragalus danicus Retz. Specimens gathered on Stinchcombe Hill have been sent in by Mr. Harford; and C. Bucknall, with Capt. Gordon, has seen it there in small quantity.

Antennaria dioica Gaertn. A tiny patch in a rough pasture at Failand has been pointed out by Mrs. Inglis.

Hypochaeris radicata L. Mrs. Sandwith draws attention to a luxuriant glabrous specimen of this plant that occurred on Ashcott peat moor. A similar form from the Isle of Wight is mentioned by Dr. Syme in *English Botany*, ed. 3, p. 130.

Veronica scutellata L. Sparingly on Yate Common; Miss Roper.

Utricularia major Schmid. On the peat in two new spots. Quite 30 plants in one of them and not growing with *U. vulgaris* in either instance.

Statice binervosa G.E.Sm. An entirely new locality, north of Kewstoke, has been discovered by F. Samson.

Carex divisa Huds. At least a dozen stems appeared last summer in the marsh under Sneyd Park.

Bromus interruptus Druce. Abundant in a field of sown fodder on the Tyntesfield estate. New to Bristol.

Calamagrostis Epigeios Roth. Thos. Clark's old station on the peat, near Shapwick, was confirmed by the writer after an interval of 70 years.

Taxus baccata L. The account of notable local Yews given in the *Flora* should have been enriched by the mention of a famous tree standing in Alveston Old Churchyard. In Part VIII. of *Etchings of Views and Antiquities in the County of Gloucester*, by Samuel Lysons, is a drawing (Pl. xxvi.) of Alveston Church with the Alveston Yew in the foreground. The plate is dated 1793 and was one of those cancelled by Lysons when he re-issued this

work in 1803 under the title of *A Collection of Gloucestershire Antiquities*. The text accompanying the plate in the original work states: "The Yew Tree seen in the Foreground is a very remarkable one. The trunk at a small Distance from the Ground swells out to a considerable Size, being twenty-three Feet in Circumference at the largest part and apparently sound." Mr. H. W. Bruton, of Gloucester, who possesses the original drawing prepared by Lysons, measured the tree in October, 1887, and found its girth to be 25ft. 6in.* At Christmas, 1913, the hollow trunk of this tree was examined by the present writer. It had split in two places showing gaps between two and three feet wide. The portion between the splits was leaning outwards under the weight of a heavy bough, and seemed likely to fall at no distant date.

* See *Notes and Queries*, II. S. VIII. 475.

Bird Notes for 1913.

By D. MUNRO SMITH.

THE Hawfinch (*Coccothraustes vulgaris*) is often thought to be a rather rare species, but in many, if not all, of the southern counties is quite abundant. It is said to have much increased of late years, but we have to remember that observers have much increased in numbers, during the last fifty or sixty years. As proof of its commonness close to the city during the breeding season, I found this May four Hawfinchs' nests and eggs in a small area between Bridge Valley Road and the Promenade. The nests on the Downs are usually placed at a fair height, in the upper boughs of a big hawthorn, and made almost entirely of bits of wood-bine and little brittle twigs of clematis, lined with fibres from the main stems of the latter plant. The curiously-marked eggs are laid in the first half of May, and all the nests I found this year were found by recognising the twittering the hen makes when fed on the nest by the cock. It might be mistaken for the noise a young robin makes when fed.

The Redshank (*Totanus calidris*). The Rev. F. Blaythwayt, in the *Victoria History of Somerset*, says: "I have evidence that the Redshank has nested recently on Stert Island and probably nests elsewhere in the county." I had the luck to find a nest and four eggs in Somerset within thirteen miles of Redcliffe Church as the crow flies. The birds had been known to haunt the spot in previous breeding seasons, though the eggs were not found. They nest in marshy ground usually under a tuft of grass. This one was under a tuft, the blades of grass being bent over the nest, evidently by the birds. The hen sat pretty closely at times, the cock being always pretty close to keep watch.

Curlews (*Numenius arquata*). Nested on the Mendips again this year, although I was not successful in my hunt for the eggs.

List of Mycetozoa found near Bristol.

BY AGNES FRY.

IT has been suggested to me that it would be of interest to readers of this journal to have a list of the Mycetozoa found near Bristol. All in the subjoined list have been found in the parish of Wraxall, and most of them at Failand. I include only those which I have myself come across. A few others are given for the district in the Victoria History of the County of Somerset (See Vol. I., p. 68). The names given first are those of the second (last) edition of Lister's Mycetozoa, but as the names in the first edition of that book and the first edition of the British Museum Guide may be more familiar (and, indeed, hard to forsake) I have added them in brackets.

Mycetozoa found at or near Failand, named according to second (last) edition of Lister's Mycetozoa :—

Ceratiomyxa fruticulosa (*C. mucida*).

Badhamia utricularis.

„ *panicea*.

„ *psittacinum*.

Physarum viride.

„ *nutans*.

„ *compressum*.

„ *didermoides*.

„ *sinuosum* (*P. bivalve*).

Fuligo septica.

Craterium minutum (*C. pedunculatum*).

„ *leucocephalum*.

„ *aureum* (*C. mutabile*).

Leocarpus fragilis (*L. vernicosus*):

Diderma spumarioides (*Chondrioderma spumaroides*).

„ *hemisphericum* (*C. Michelii*).

„ *effusum* (*C. reticulatum*).

„ *radiatum* (*C. radiatum*).

Diachaea leucopoda (*D. elegans*).

Didymium difforme.

„ *Clavus*.

„ *nigripes*.

„ „ *v. Xanthopus*.

„ *squamulosum* (*D. effusum*).

Mucilago spongiosa (*Spumaria alba*).

Lepidoderma Carestianum v. Chailletii.

Stemonitis fusca.

„ *splendens v. flaccida*.

„ *flavogenita* (*S. ferruginea*).

„ *ferruginea* (*S. Smithii*).

- Comatricha nigra* (*C. obtusata*).
 „ *typhoides*.
Enerthenema papillatum (*E. elegans*).
Lamproderma scintillans (*L. irideum*).
Amaurochaete fuliginosa (*A. atra*).
Cribraria argillacea.
 „ *aurantiaca*.
Dictydium cancellatum (*D. umbilicatum*).
Licea flexuosa.
Tubifera ferruginosa (*Tubulina fragiformis*).
Dictydiaethalium plumbeum.
Reticularia Lycoperdon.
Lycogala epidendrum (*L. miniatum*).
Trichia affinis.
 „ *persimilis*.
 „ *scabra*.
 „ *varia*.
 „ *decipiens* (*T. fallax*).
 „ *Botrytis* v. *lateritia*.
 „ „ v. *flavicomma*.
 „ *contorta*.
Hemitrichia Vesparium (*H. rubiformis*).
 „ *clavata*.
Arcyria ferruginea.
 „ *cinerea* (*A. albida*).
 „ *pomiformis* (*A. albida* var. *pomiformis*).
 „ *incarnata*.
 „ *denudata*.
 „ *nutans* (*A. flava*).
 „ *Oerstedtii*.
Perichæna depressa.
 „ *corticalis* (*P. populina*).
 „ *vermicularis* (*P. variabilis*).

Observations on Ants.

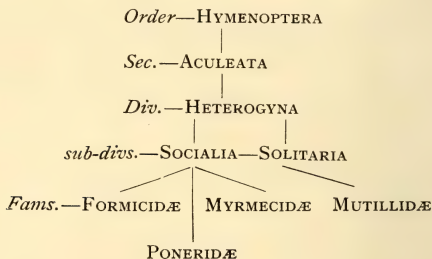
By WM. A. SMALLCOMBE.

HAVING had little experience in lecturing or paper reading, you will, I hope, excuse me if my remarks are a little disjointed. However, I will do my best to tell you something about those tiny creatures—Ants.

Firstly, it will be as well to see where Ants are placed in the classification of insects.

They belong to that great order called Hymenoptera, which means that they are insects which undergo complete metamorphosis and possess four naked wings.

The table is as follows :—



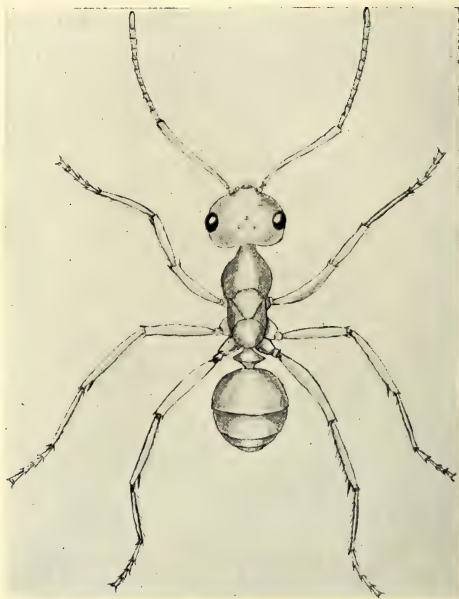
My remarks will deal only with the social Ants. The body of the Ant is divided into three main portions—head, thorax and abdomen. The first segment of the abdomen is constricted, forming a node or petiole.

It is chiefly because of the differences found in these nodes that the Ants are split into families.

All Ants pass through four stages—ovum, larva, pupa and imago. The ova are very minute whitish bodies, which are held together in little masses of 20 or 30 with some transparent glutin. It is interesting to note that the eggs grow somewhat after being laid.

The larvæ hatch from the ova as little white grubs, which are quite devoid of legs. The body is segmented and slightly hairy; the head is bent round acutely. The larvæ are quite unable to walk or to feed themselves. In the Formicidæ and Poneridæ the pupæ are enclosed in cocoons (commonly known as ants' eggs). The cocoons are composed of fine silk which is made firm by some liquid exuded by the larvæ. When a larva is full, the

PLATE I.



FORMICA FUSCA ♀. Length 6 mm.

Ants surround it with little pellets of earth. Inside this chamber the larva by muscular efforts can revolve and so surround itself by a cocoon of silk.

The imagines or perfect Ants emerge from the pupæ, some with and some without wings.

Those with wings are either ♂ or ♀, and those without are ♂ ♀, or what are really neuter ♀ ♀.

Every year, usually in July, August and September, a large number of ♂ ♂ and ♀ ♀ are born.

When atmospheric and probably other conditions which are unknown to us, are suitable, practically all the ♂ ♂ and ♀ ♀, of one species in a field, leave their respective nests and fly into the air. If it is very windy the Ants are carried long distances—thus well distributing the species. Copulation occurs in the air, after which both ♂ and ♀ pitch—the ♂ to die and the ♀ to form a new colony. It is the formation of new nests which is a vexed question with entomologists. That new nests are formed is undoubted, but I know of no record of freshly fertilised ♀ ♀, starting a new nest, except in captivity. I have myself seen Ants swarm, and watched the ♀ pitch after fertilisation; also I have watched the ♀ break off her own wings, but I have never succeeded in inducing her to start a colony. I think, myself, that the new queen enters the earth and lays a few eggs. These hatch and she tends the larvæ until eventually they develop into workers.

At this point the queen stops work, and simply lays eggs, while the workers tend her and her offspring. In several years quite a big colony can be formed in this way. I do not think it is a rule that new queens enter already established nests, as in every case I have tried, the new queen was killed.

Ants have a great love for their queen, and a detachment of workers are continually cleaning, licking, and caressing her. Even in death they do not forsake her. A striking instance of this occurred in one of my nests of *Lasius flavus*. The queen, after living happily for a year with the workers, died. Instead of taking the remains to the corner of the nest (as is usually done when a ♀ dies), they caressed and paid homage to the remains for over eight months at which period the poor queen was in three pieces.

If the nest was disturbed, the first thing the workers did was to take the dead queen to a place of safety. At different times, I introduced three queens into this nest, but they were promptly killed.

Of the forty species of British Ants, I have succeeded in discovering ten in Somerset and Gloucester, the names of which

have been confirmed by Mr. H. Donisthorpe, of London, to whom I am much indebted.

The largest British Ant (*Formica sanguinea*), I have not yet found. It is an extremely interesting species on account of its slave-making habits.

Having developed to such an extent the art of raiding other nests and thieving cocoons, these Ants have so degenerated that now they are unable to rear their own larvæ, and hardly ever feed themselves. Their slaves are all of one species—*Formica fusca*. The method of attack is as follows :—

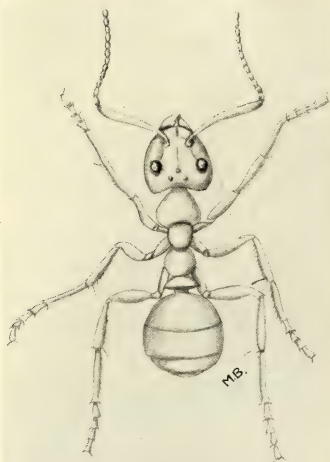
During the day the workers of *sanguinea* roam about outside their nest for quite a considerable distance. During these rambles one or more of the Ants discover a nest of *F. fusca*. This news is communicated to their fellows (or really sisters) and generally, between the hours of four and six p.m. a strong detachment of *sanguinea* approach the nest of *fusca*.

A fierce fight ensues but the *sanguinea* are always victorious. While some are fighting, others are carrying cocoons back to their nest. (It is remarkable that only ♀ cocoons are taken). This struggle continues until all the cocoons are carried to the *sanguinea* nest. The Ants hatching from these cocoons, as if quite naturally, spend their lives looking after their masters. Another species with which I have made personal acquaintance is *Formica rufa*—the wood or horse Ant. In size it is nearly as large as *sanguinea*. The nest, which is composed of a huge pile of small sticks, grass stems, and pine needles, is generally situated in a pine or fir wood.

On Stinchcombe Hill, near Dursley, are to be seen several nests. One nest in particular I have observed for several years. It is situated a couple of feet off the main path through the wood. The nest is about two and a half feet high and about two yards across at the base. In 1912, on a very hot day in July, I inspected this nest. It was a wonderful sight—the mound being covered with one mass of Ants. Leading from the nest to the path was a well-worn trail, and Ants were pouring in thousands, backwards and forwards, to and from the nest. While watching, I saw numerous larvæ (*Hybernina brumata*), cockchafers' wings, beetles, flies, and a host of small insects being carried to the nest. Everyone was in a desperate hurry. All around the nest for thirty yards, Ants could be seen on every bush and tree—many milking aphides. I disturbed the nest with a trowel, and took a tin box full of ants, sticks and all. Inside the mound I found the stump of a tree, which was completely honeycombed. In the depressions in the galleries were large quantities of cocoons.

That day I caught several ♂♂ and ♀♀ with wings, and also I discovered that there were ten proper queens in the tin box which I had scooped up. It is rather remarkable that so many

PLATE II.



FORMICA RUFA ♀. Length 8 mm.

queens should exist in one nest. In the nest of *Lasius flavus* or *L. niger* you seldom find more than one or two; although on the other hand the red Ants usually have about six queens. However, to return to the wood Ants. I again visited the nest this summer in company with Mr. Bartlett. It was an extremely wet day and everything, including ourselves, was soaked with rain. One author says that *F. rufa* closes up the nest on wet days. I certainly did not find this the case, because there were hundreds of ♀ minors all over the brambles.

They were engaged in milking aphides. No ♀ ♀ were found that day, but there were plenty of ♂ ♂. The Ants which I took that day thrived well in captivity until about a month ago, when a small species of mite (acari) invaded the nest. These increased so rapidly and covered the Ants to such an extent, that nearly all are dead. If I could procure some myrmecophilous beetles (those found in Ants' nests) and put them in the artificial nest, they would probably have eaten all the mites. *Formica rufa* are very strong, carrying sticks much heavier than themselves, and they carry one another about, seemingly without effort. I made some experiments to test the sight of this species. If I passed my hand three feet above the nest slowly, the Ants did not see it, but if the hand was moved suddenly, they immediately stood on their hind legs and looked as formidable as they possibly could. When I stamped my foot twelve feet away from the nest, they would all jump around in that direction. The small yellow Ant (*Lasius flavus*) can only distinguish objects half an inch away. One day I put a small ichneumon fly in a nest of *flavus*. When the fly passed within a half-inch of the Ant, the Ant would immediately give chase, but lost the fly when it got more than the half inch away. The sight of the ♂ and ♀ Ants are much better developed than the ♀. The ♀ ♀ in most species have only one pair of faceted eyes, but the ♂ ♂ and ♀ ♀ have three ocelli in addition to the faceted eyes. (The ♀ ♀ of *F. rufa* has ocelli).

These ocelli are simple eyes arranged in the form of a $\triangle$ on the top of the head.

The small yellow Ant (*Lasius flavus*) is one of our commonest species. The nests are generally formed by throwing up small mounds of earth, or more rarely underneath stones. Two distinct sizes of ♀ ♀ are always to be found—called ♀ major and ♀ minor. From my own observations the ♀ minors appear to look after the ova in the nest, while the majors do everything else, such as milking aphides, feeding larvæ, attending and cleaning the queen, building new chambers, defending the nest from other Ants, continually removing pupæ to different parts of the nest, etc.

A number of aphides can always be found attached to the roots of grass, which are growing down through the nest. These aphides are, I think, the main support of *flavus*, because you never

see this species out hunting. If we look at the little black Ant (*Lasius niger*) we shall find that it not only keeps aphides in the nest, but also regularly milks aphides, which are on plants and trees growing near the nest.

Several times I have found little clods of earth fixed on grass stems, inside of which were many aphides, which were regularly attended by Ants.

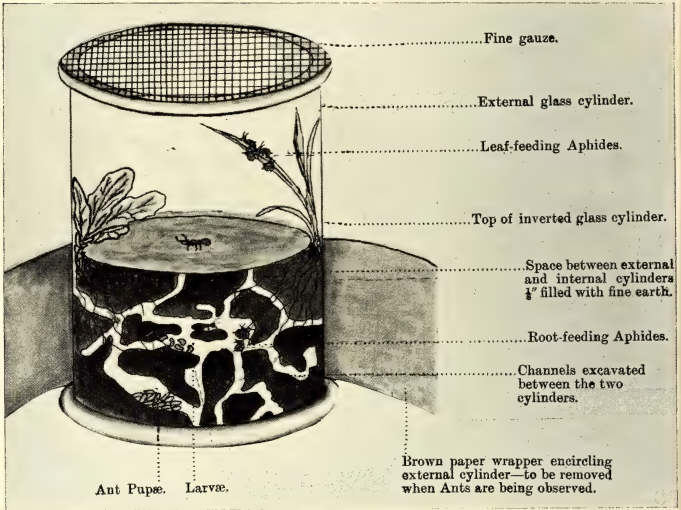
This species is fond of a stray fly or caterpillar for which it goes to endless trouble to carry to its nest. Living with most Ants are to be found a few beetles. The beetles are generally rare species and are well tended by the Ants. Some of them exude from the base of a tuft of hairs near the posterior end of the body a sweet juice which the ants drink with evident relish. These beetles are useful to the Ants because they eat or kill the mites, to which Ants are very subject to attack. There is also another strange animal which is found in almost every nest. It is like a tiny white wood-louse, and is quite blind. It glories under the name of *Platyarthrus Hoffmanseggii*. Its relation to the Ants is unknown. I have never seen them take the slightest notice of one another. Some authorities have supposed it to act as a scavenger.

Another species of Ant (*Lasius alienus*) which I have just discovered on Durdham Downs, is very similar to *L. niger*, but is smaller and has no hairs on the tibiae. It lives among small loose stones and raises a cone of earth over the entrance to its nest. Another species not recorded for Bristol is *Lasius mixtus* which I have found in quantity at Leigh and Long Ashton. It is slightly larger than *flavus* and darker yellow. The habits are apparently the same as *flavus*.

The red or stinging Ants are fairly well represented here. The commonest is *Myrmica lævinodis*, distinguished from all others by possessing smooth nodes. It is common in the University garden and at Leigh. A rather rarer species is *M. scabrinodis*, two nests of which I have found at Leigh. This Ant is distinguished by the abrupt bend at the base of the antenna.

M. lobicornis is very local, and I have only found one specimen (and that one was a queen) in the middle of a nest of *L. mixtus*. This species has a peculiar thickening at the base of the antenna—hence its name. In many cases I have found mixed nests. These are not mixed in the true sense of the word, because each species keeps to its own side of the nest. If the mound is disturbed, each kind fight furiously with the other. At Leigh I have found one mound containing *F. fusca*, *L. flavus* and *M. lævinodis*. Often I have found *L. flavus* and *L. niger* under the same stone—but keeping apart. When these two species are found like this, in every case, I have found the channels of *niger* are strewn with dead *flavus*. If *flavus* and *lævinodis* are living close to one another, a number of corpses of *lævinodis* are found among the *flavus*. Although *lævinodis* is provided with a sting it very

PLATE III.



seldom uses it. The red Ants generally are much more sluggish and nothing like so plucky as the formicidæ. Among the most formidable Ants of the world are the African Driver Ants. The ♂♂ of this species are specialized for different work. The soldiers have very large heads and big jaws. The Ants are continually on the march carrying all their offspring with them. When on the march they keep in very uniform order. It is said that any animal that will not move from their path is as good as dead. When an army of Driver Ants approaches a native village, the inhabitants clear out of the way and allow the Ants to pass unmolested. Their numbers are millions and sometimes it takes days for a complete army to pass a certain point. Another interesting species of foreign Ant is called the honey pot. These are found in Australia. During the autumn the ♀♀ collect as much honey as possible, and this is how they store it. Some ♀♀ are told off to fix themselves up to the roof of the nest. In this position they are overfed with honey until their abdomens are so distended as to appear like balls of honey. Then during the season of no work, the other ♀♀ come and tap their barrels of honey and so obtain food. One observer states that the ♂♂ take it in turns to be made into barrels.

There is one more species I would like to mention, which is really not an Ant. This is the Termite or White Ant. It belongs to the Neuroptera, and so is distinct from true Ants. Their habits are very similar, except that there is a king and queen always in the nest. A young queen is quite a small insect, but with age it increases enormously, until the abdomen is two inches long. The sole work of the queen is to lay eggs, and this she does in millions. These termites are very destructive creatures. They enter houses from underneath the ground and work upwards. Through the floor they come and up through the legs of the tables and chairs, until one day the furniture collapses to a heap of dust. When destroying wood they always leave the outside skin intact, so that one does not suspect what is going on inside.

List of species found in Somerset and Gloucester :—

SOMERSET.	GLOUCESTER.
Formica fusca.	Formica rufa.
Lasius niger.	Formica fusca.
Lasius flavus.	Lasius niger.
Lasius mixtus.	Lasius flavus.
	Lasius mixtus.
	Lasius alienus.
Myrmica Lævinodis.	Myrmica Lævinodis.
Myrmica scabrinodis.	Myrmica scabrinodis.
Myrmica lobicornis.	
	Myrmecina graminicola.

Supplement.—From the results of experiments I have made a type of artificial nest, which up to the present time seems to have fulfilled all the conditions necessary for the close observation of Ants, under as nearly as possible, natural conditions.

List of Publications bearing on the Geology of the Bristol District for the years 1896—1913.

THE following list is a continuation of that published in 1913 in the Proceedings of the Bristol Naturalists' Society, and has, like its predecessor, been prepared under the superintendence of Prof. S. H. Reynolds, in the Geological Department of the University of Bristol by Mr. J. E. Livingstone.

1896.

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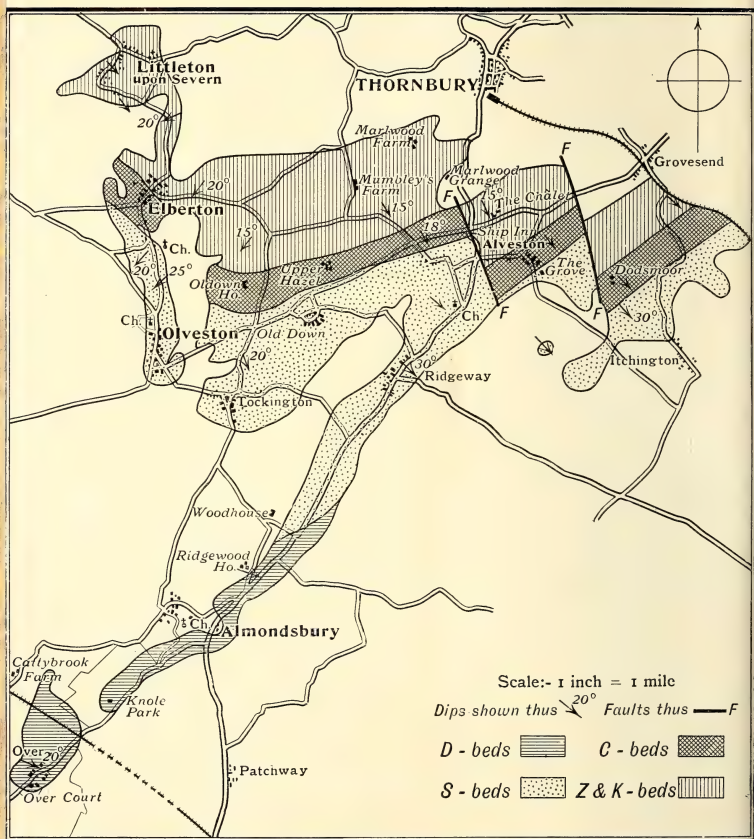
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Map showing the Carboniferous Limestone between Over and Tytherington, Gloucestershire.

On the Carboniferous Limestone of the district between Over and Tytherington, Gloucestershire.

BY S. H. REYNOLDS, M.A., SC.D., AND D.E. INNES, B.A.

I.—INTRODUCTION.

OUR object in this paper is to trace the sub-divisions established by Dr. A. Vaughan for the Carboniferous Limestone of the Avon Section over a part of the Bristol area where the rocks have not hitherto been examined in detail. The rocks under consideration form the western and north-western part of the rim of the Bristol coalfield. From Over at the southern end of the area they extend north-eastwards through Almondsbury and Ridgeway to Alveston, forming a narrow ridge-like outcrop rarely more than a quarter of a mile wide, and often very much less. This ridge is followed by the Ridgeway, formerly the old Roman road to the north, and now the main road between Bristol and Gloucester. At Alveston the outcrop suddenly widens, and the Carboniferous Limestone extends westwards to Tockington, and though partly concealed by the Trias, to Olveston, Elberton and Littleton-upon-Severn. Eastwards from Alveston as far as the termination of our map along the line of the railway between Tytherington and Grovesend the outcrop narrows somewhat, and the strata are shifted southwards by two faults.

It should be stated that we have not attempted to re-map the outcrops in detail, but have in the main copied the boundaries from the 1-inch survey map. In places, however, we have found it necessary to differ from the Survey mapping.

II.—PREVIOUS WORK.

C. Richardson,¹ in 1862, gave an account of the section seen in the railway cutting and tunnel north of Over on the Severn Tunnel line.

Though a re-description of the Tytherington-Grovesend railway section does not come within the scope of this paper, it is desirable to allude to former papers upon this fine section. It was described in 1888 by Prof. Lloyd Morgan² whose paper was illustrated by a detailed section and coloured map. The Rev. H. H. Winwood

¹ Rep. Brit. Ass. for 1861 (Manchester), Trans. of Sections, p. 130.

² Proc. Bristol Nat. Soc., new ser., Vol. VI. pp. 1-17.

contributed a paper on the section to the Proceedings of the Cotteswold Naturalists' Field Club¹ in 1889, and described it at the Bath meeting of the British Association² in 1888.

Dr. Vaughan, in his classical paper on 'The Palæontological sequence in the Carboniferous Limestone of the Bristol Area'³ (1905) gave a full account of the section. In the same paper brief allusion is made to quarries at Old Down E. of Olveston, and on the Ridgeway.

III.—DESCRIPTION OF THE EXPOSURES.

Dibunophyllum-Zone.

All the exposures of the southern end of the area from Over as far as Woodhouse, appear to belong to this zone. By far the best section of these beds is in the cutting W. of the Over tunnel. To the E. of the road the dip is south-easterly, and the rocks consist of limestone often oolitic, with shale and thick bands of red grit. Fossils are plentiful in the limestone. Similar rocks are seen W. of the bridge folded into an anticline. We hope to describe this fine section in detail at a later date. To the S. of the railway, grits are exposed in two small quarries at Over. Knole Park stands on *Dibunophyllum*-beds, limestone being exposed at several points in Over lane, and also in the grounds, where *Cyathophyllum murchisoni* and other characteristic fossils may be found. The exposures are, however, very bad. A band of grit striking N.N.E. is seen about 100 yards N. of the Lodge. This band crops out again in the fork of the road at the western end of Almondsbury Hill.

On Almondsbury Hill and to the S.W. the rocks are much disturbed and have yielded few fossils, though *Lithostrotion irregulare* may be found in the shale-bands of the old quarry below the outlook place.

An old quarry to the E. of the turning to Tockington at Ridge Wood gives a fair section of *Dibunophyllum*-beds. Here white oolitic limestone with abundant *Productus hemisphericus* is associated with rubbly limestone and shaly partings containing *Cyathophyllum murchisoni*. The most northerly exposure of *Dibunophyllum*-beds occurs near the turning to Tockington at Woodhouse Down, the exposures include grit as well as limestone. The dip of the *Dibunophyllum*-beds where undisturbed is always S.E. or S.S.E. at 35-50°.

¹ Proc. Cotteswold Nat. Field Club, Vol. IX, pp. 325-333.

² Rep. Brit. Ass. for 1888 (Bath), Trans. Sect. C, pp. 658-659.

³ Q.J.G.S., Vol. LXI, pp. 219-225.

Seminula-Zone.

These rocks occupy a very wide area. They underlie the *Dibunophyllum*-beds at Woodhouse Down and form the "ridge" till the outcrop widens at Alveston, whence they extend to Tockington and Olveston. They are well-exposed to the north of Itchington, being shifted southwards by the faults already alluded to. The upper beds as exposed are generally compact limestones with abundant *Lithostrotion martini*. But little is seen of rubbly or concretionary limestone, such as plays so prominent a part in the Sodbury section, though some indications of this lithological type occur in exposures near Alveston vicarage. As in the Tytherington section, there is a good development of fossiliferous oolite (*Seminula-Oolite*) in the lower part of the Upper *Seminula*-beds (S_2); this is best seen in a small quarry by the Methodist Chapel west of David Lane, Alveston. Another old quarry a little further S.W. is noticeable for a long bedding plane of dolomitized limestone covered with large masses of *Lithostrotion basaltiforme* and *Syringopora* finely weathered out.

There are many exposures of limestone with abundant *Lithostrotion martini* in the neighbourhood of Old Down, one being seen by the roadside leading up from Lower Hazel; these are in the lower part of S_2 . By far the best exposure of this horizon occurs, however, in the Tockington hill quarry which is in active work. This is in massive limestone, often oolitic, with *Seminula*-bands and great masses of *Lithostrotion martini* and *Syringopora* exposed on the bedding planes. The lower *Seminula*-beds (S_1) are very little seen, and the most interesting point about them is the occurrence of a well-marked band of hard red and yellow grit exposed by a cottage a third of a mile south-east of Oldown House, and reached by a turning out of Foxholes Lane. The grit has been much used for building the walls here. It is also exposed by two cattle-ponds in the fields to the south-west of Upper Hazel, and much debris occurs in the fields N. of the Alveston road at Little Down. In the 1-inch Geological Ordnance Survey Map this grit is coloured as Old Red Sandstone, and is represented as brought in by a strike fault, but there can be no doubt that this band is quite comparable to that occurring at much the same level in the Sodbury section. The Firestone-bands in the Tytherington quarry are at a higher horizon and are calcareous sandstones effervescing strongly when treated with hydrochloric acid. No effervescence occurs on treatment of the grit from near Oldown House with acid.

Throughout all the area hitherto described, the south-easterly dip is maintained, but further west the strike swings round, and throughout the band of limestone, on which Olveston stands, there are numerous exposures of *Seminula*-beds with a south-westerly dip. The best exposure is at Harn Hill quarry, Elberton, where

thin-bedded limestone overlies black bituminous limestone with abundant *Lithostrotion*.

The *Seminula*-beds near Itchington are, as has been already mentioned, completely off the strike of those further west. They are best seen in an old quarry recently re-opened near Owl'snest Farm; here they consist of compact limestone with china-stone and shale bands. *Lithostrotion* is plentiful and the lithological character suggests S_1 .

Syringothyris-Zone.

These rocks are well seen in the quarries and cuttings by the Tytherington railway, but other exposures are few and far between. We know of only two in the area between the railway section and Alveston, one being S. of the farm called Dodsmoor, the other in the grounds of Alveston House; both these are in the *Caninia*-oolite. The extensive quarries W. of the Ship Inn at Alveston Green are opened in the main in the *Caninia*-oolite which has quite the usual character, being very unfossiliferous and showing little in the way of bedding planes. The underlying *Laminosa*-dolomite is exposed at three points just to the N. of the road between Alveston and Old Down. Thin-bedded limestone sometimes dolomitic, seen near a new house 300 yards S.W. of Oldown House probably belongs to the *Syringothyris*-zone. We have no fossil evidence of the presence of these beds at Elberton.

Zaphrentis-Zone.

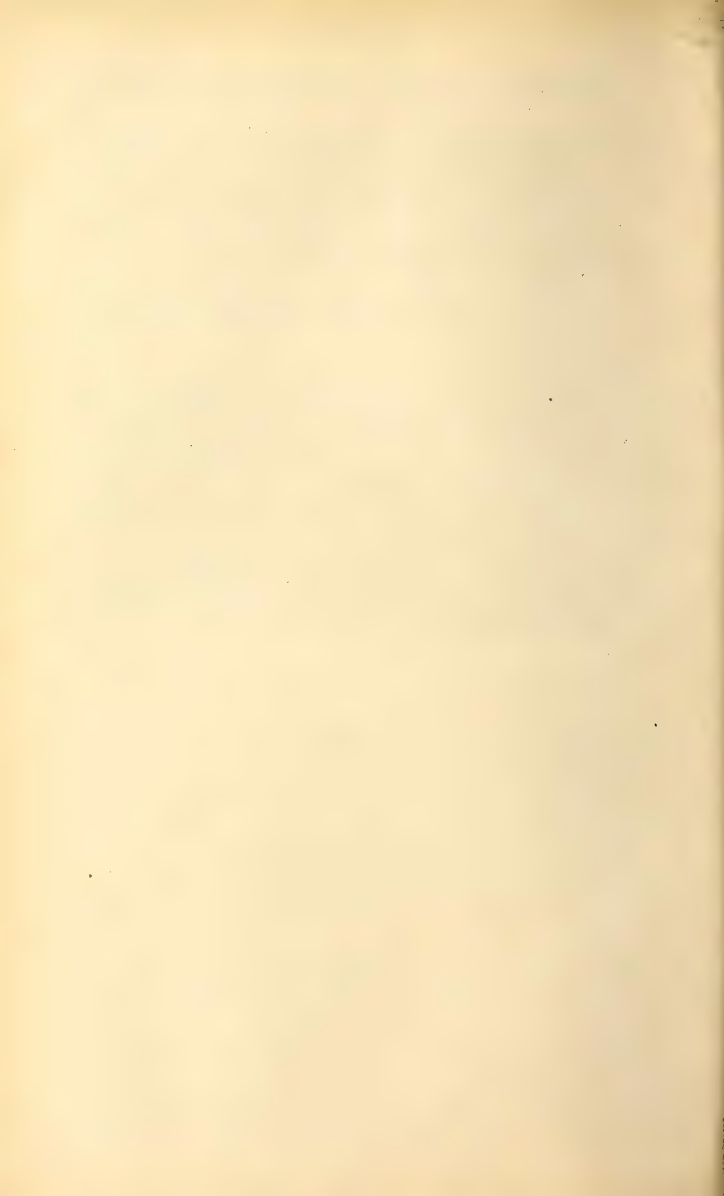
Passing westwards from the Tytherington-Grovesend railway section the first exposure of the *Zaphrentis*-beds is a very poor one at the southern end of Abbey Lane; other equally bad exposures are seen in the bed of the small stream which flows towards Owl'snest Farm. *Orthotetes crenistria*, *Chonetes hardrensis*, and *Spirifer clathratus* are plentiful in the hedge-banks between these two exposures. A little further to the west the more easterly of the faults alluded to above shifts the outcrop, and the next exposure met with is by the side of the main road to Gloucester N.N.W. of Alveston House.

In the grounds of The Chalet, Alveston, there are good exposures of the *Zaphrentis*-beds. The quarry near the road is in compact crinoidal limestone with chert, and in a temporary exposure to the S.E. of the house thin-bedded limestone with abundant *Spirifer clathratus*, *Orthotetes crenistria*, *Cliothyris glabistria* was seen, the dip being such as to bring the beds over the compact limestone of the quarry. Similar beds are seen in the grounds of a cottage near the tenth milestone from Bristol. Crinoidal limestone with the usual fossils of the *Zaphrentis*-beds occurs in an old quarry by Vattingstone Lane, N. of the Alveston

Down quarries, and the same beds are seen in a copse S.W. of Marlwood Grange. At the end of Foxhole's Lane, a third of a mile N.N.E. of Oldown House, similar beds are seen with a south-westerly dip, and a similar dip was obtained in an old quarry north of Oldown House. The finding of a fish tooth—*Helodus turgidus* suggests that we have here the upper part of Z_2 the horizon of the 'fish beds' of the Avon Section.

Highly fossiliferous *Zaphrentis*-beds are exposed practically continuously for a distance of a quarter of a mile by the roadside to the E. and W. of Camp Farm at Elberton; the road practically follows the strike.

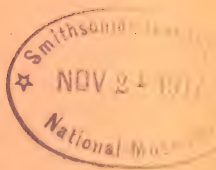
Zaphrentis-beds probably form the whole of the limestone mass with an irregular outcrop extending between Elberton and Littleton. At the northward bend of the road E. of Court Farm, Elberton, crinoidal limestone with abundant *Orthis crenistria* occurs, and similar beds are seen at the fork of the road W. of Hay Wood. At both these spots the dip is 20° S.W. At the pond in the fork of the road S.E. of Littleton silicified crinoidal limestone with *Orthis crenistria*, *Spirifer clathratus* and *Syringothyris laminosa* dips S.E. Similar beds are seen in the old quarry N. of the White Hart Inn, in a farmyard exposure W. of the turning to the Church, and in a little old quarry a short distance N. of the Church. The *Clestopora*-beds are, as far as we know, nowhere exposed in the area described.



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Miss I. M. ROPER, F.L.S.

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President—CEDRIC BUCKNALL, Mus. Bac., 13 Whatley Road, Clifton.

Entomological :

President—G. C. GRIFFITHS, F.Z.S., F.E.S., 3 Leigh Road, Clifton.

Secretary—CHARLES BARTLETT, 18 Henleaze Avenue, Westbury-on-Trym.

Geological :

President—S. H. REYNOLDS, M.A., Sc.D., F.G.S., The University, Bristol.

Secretary—B. A. BAKER, F.G.S., 93 Cotham Brow, Bristol.

Honorary Members (up to May, 1915).

Prof. George S. Brady, M.D., LL.D., D.Sc., F.L.S., F.R.S., Park Hurst, Endcliffe, Sheffield.

Henry J. Charbonnier, Haw Lane, Olveston, Tockington, R.S.O., Glos.

G. A. Lebour, Esq., M.A., F.G.S., Professor of Geology in the Armstrong College, Newcastle-on-Tyne.

R. M. Prideaux, F.E.S., Brasted Chart, nr. Sevenoaks, Kent.

Prof. Sir Wm. Ramsay, Ph.D., F.R.S., 19 Chester Terrace, Regent's Park, London.

Prof. H. S. Hele Shaw, M.Inst.C.E., LL.D., F.R.S., 64 Victoria Street, Westminster.

Prof. W. J. Sollas, M.A., LL.D., F.G.S., F.R.S.E., F.R.S., University Museum, Oxford

Prof. S. P. Thompson, D.Sc., B.A., F.R.A.S., F.R.S., City and Guilds' Technical College, Leonard Street, Finsbury, London, E.C.

Sir W. A. Tilden, D.Sc., F.R.S., Professor of Chemistry in the Imperial College of Science, S. Kensington, London, S.W.

William Whittaker, Esq., B.A., F.G.S., F.R.S., Freda, Campden Road, Croydon.

Prof. A. M. Worthington, C.B., M.A., F.R.A.S., F.R.S., Royal Naval Engineering College, Greenwich.

Prof. Sydney Young, D.Sc., F.R.S., Trinity College, Dublin.

List of Members

(completed up to May, 1915).

A Signifies Associate Member.

P Signifies those who have contributed Papers printed in the "Proceedings" of the Society.

L Signifies those who have compounded for their Annual Subscription.

A	Almond, Stanley	...	...	Edenhurst, Pembroke Road, Clifton
	Armory, T. H.	...	...	29 Beaufort Road, Clifton
	Atkinson, E. C.	...	...	5 Pembroke Vale, Bristol
A	Audcent, H. L.	...	...	34 Belvoir Rd., St. Andrew's, Bristol
	Badock, Stanley H.	...	...	Holmwood, Westbury-on-Trym
P	Baker, B. A., F.G.S.	...	...	93 Cotham Brow, Bristol
A	Balfour, A., B.A.	...	...	25 Beaufort Road, Clifton, Bristol
A	Ball, Miss Caroline M.	...	...	Upper Belgrave Road, Bristol
A	Barke, H. F.	...	...	Western Counties' Laboratory, 11 College Green, Bristol
	Bartlett, Chas.	...	...	Rostock House, Woodhill, Portishead
	Beames, F., B.Sc.	...	...	9 Osborne Road, Clifton
P	Blackmore, J. C., F.G.S.	...	...	36 Whatley Road, Clifton, Bristol
	Blood, Geo. E.	...	...	15 Clyde Road, Redland, Bristol
A	Brebner, Mrs. G.	...	...	22 Victoria Road, Cotham, Bristol
P	Bucknall, C., Mus. Bac.	...	...	13 Whatley Road, Clifton, Bristol
A	Carpenter, E.	...	...	Kennmore, Henleaze Road, Bristol.
	Cay, Arthur	...	...	Lyndhurst, Leigh Woods, Bristol
	City Librarian	...	...	Central Library, Bristol
A	Clarke, A.	...	...	16 Woodstock Rd., Redland, Bristol
	Cook, E. H., D.Sc.	...	...	27 Berkeley Square, Bristol
	Cornaby, H. B.	...	...	8 York Place, Clifton
	Cottle, A. W.	...	...	Black Horse Hotel, Kingswood, Bristol
	Crook, Miss	...	...	16 Berkeley Road, Westbury Park, Bristol
A	Crozel, Prof. G.	...	...	Chemin des Célestins, 17 Oullins (Rhône), France
A	Curran, F. C.	...	...	49 Springfield Road, Cotham
	Darbishire, O. V., Ph.D.	...	...	The University, Bristol
L	Darell, D., F.G.S.	...	...	Hillfield House, Stoke Fleming, near Dartmouth
	Davies, A. J.	...	...	Avon House, Keynsham, Bristol
	Davies, J. H.	...	...	Down House, Stoke Bishop, Bristol
	Davis, M. J. L.	...	...	Lyndhurst, St Ronan Avenue, Bristol
A	Dixon, Miss	...	...	Colston Girls' School, Bristol
A	Drew, Miss	...	...	36 Lower Redland Road, Bristol
	Dunscombe, M. W.	...	...	5 St. Augustine's Parade, Bristol
	Dunscombe, Miss	...	...	1 Quadrant, Redland
	Fortey, Chas.	...	...	9 Belgrave Road, Tyndall's Park, Bristol
	Fry, Francis J.	...	...	Cricket St. Thomas, Chard
P	Fryer, A. C., Ph.D.	...	...	13 Eaton Crescent, Clifton
A	Gimingham, C. T.	...	...	Cider Institute, Long Ashton
A	Goulding, Thomas	...	...	6 Nelson Street, Bristol
	Green, Upfield	...	...	8 Bramshill Road, Harlesden, London, N.
	Griffiths, G. C., F.E.S.	...	...	Penhurst, 3 Leigh Road, Bristol
A	Griffiths, Miss D. N.	...	...	Penhurst, 3 Leigh Road, Bristol

A	Grove, Otto	...	...	Cider Institute, Long Ashton
	Gummer, Horace	...	...	Herbert Lodge, Cotham Park, Bristol
A	Hardy, C. C.	...	...	2 First Avenue, St. Anne's Park, Bristol
	Harris, E., M.D.	...	...	13 Lansdown Place, Bristol
	Henderson, W. D., Ph.D.	...	...	The University, Bristol
	Herbert, Josiah	...	...	4 Southfield Road, Cotham
	Hiley, G. H.	...	...	65 Clifton Park Road, Bristol
A	Hill, Miss Edith	...	...	Holford House, Portbury
	Hippisley, H. E., M.A.	...	...	South Lawn, Ston Easton, Bath
	Hodgson, C. J.	...	...	5 Cotham Terrace, Bristol
	Hony, G. B.	...	...	4 Beaufort Road, Clifton
A	Horder, Miss M. G.	...	...	Highweek, Brislington, Bristol
	Hoyle, W. E., D.Sc.	...	...	National Museum, Cardiff
L	Hudd, A. E., F.S.A.	...	...	108 Pembroke Road, Clifton, Bristol
	Humpidge, H. J.	...	...	Stratheden, Eaton Crescent, Clifton
	Hunter, C., M.Sc.	...	...	The University, Bristol
	Innes, D. E. I.	...	...	The University, Bristol
	Isaac, C.	...	...	15 Cotham Vale, Redland
	Ivens, H. P.	...	...	18 Alexandra Road, Clifton, Bristol
	Ivens, W. B.	...	...	49 Ravenswood Road, Redland
	Jolly, H. F.	...	...	Glenavon, Clifton Down, Bristol
A	Just, Mrs. Ulrich	...	...	57 Hampton Park, Redland
	Kemp, J. T., M.A.	...	...	Silver Birches, 4 Cotham Grove, Bristol
A	Knowlson, James F.	...	...	9 Downfield Road, Clifton
A	Knowlson, Mrs.	...	...	9 Downfield Road, Clifton
	Lang, C. J.	...	...	6 Florence Park, Redland
A	Lee, Miss E. M., M.Sc.	...	...	The University, Bristol
A	Lees, A. H.	...	...	Cider Institute, Long Ashton
	Lees, D. L.	...	...	Chesterfield House, Queen's Road, Bristol
	Linton, Dr. Marion, M.B.	...	...	7 Tyndall's Park Road, Clifton
	Lippincott, R. C. Cann	...	...	Overcourt, near Bristol
	Llewellyn, W. H.	...	...	8 Cotham Lawn Road, Bristol
A	Lucas, Miss	...	...	Swanswick House, Shirehampton
	McIntyre, Miss	...	...	67 Claremont Road, Bristol
	MacIver, Miss	...	...	Wolverton House, Clifton Park, Bristol
A	Mackie, The Rev. J. H.	...	...	The Rectory, Filton
	Mappin, S. W.	...	...	100 Pembroke Road, Clifton, Bristol
	Matthews, H. E.	...	...	30 The Mall, Clifton
A	Mockeridge, H. D.	...	...	15 Hartingdon Park, Bristol
P	Morgan, C. Lloyd, LL.D., F.R.S.	...	...	5 Kensington Place, Bristol
P	Morgans, Thos., M.I.C.E.	...	...	60 Queen's Square, Bristol
A	Mortimer, Mrs. C.	...	...	4 Cambridge Park, Bristol
	Mountney, P. J.	...	...	83 Park Street, Bristol
A	Mullock, Miss	...	...	23 Berkeley Square, Bristol
	Norman, G., M.D.	...	...	12 Brock Street, Bath
A	Northmore, John	...	...	49 Manor Park Road, Redland
A	Nuell, F. A.	...	...	63 Springfield Road, Cotham
P	Prowse, A. B., M.D.	...	...	5 Lansdown Place, Bristol
A	Prowse, Mrs.	...	...	5 Lansdown Place, Bristol
A	Prowse, Miss	...	...	9 Saville Place, Clifton, Bristol
	Pullin, W. H.	...	...	56 St. John's Road, Clifton
	Rafter, J., M.A.	...	...	The University, Bristol
A	Randall, Miss Alice	...	...	23 Hanbury Road, Clifton
	Read, E. H.	...	...	Beaufort House, Victoria Road, Bedminster.
P	Reynolds, S. H., M.A., Sc.D.	...	...	13 All Saints' Road, Clifton
A	Reynolds, Miss J. B.	...	...	30 Cornwallis Crescent, Clifton
	Richardson, Frank	...	...	15 Percival Road, Clifton

	Robson, V. E., ...	41a, Ravenswood Road, Redland
P	Roper, Miss I. M., F.L.S. ...	4 Woodfield Road, Redland
P	Rudge, C. K., L.R.C.P., M.R.C.S.	145 Whiteladies Road, Clifton
	Salter, Mrs.	187 Coldharbour Road, Redland
	Sandwith, Mrs.	26 Canynge Square, Bristol
	Savory, J. H.	Rodney Place, Clifton
	Scott, W. G.	25 Duke Street, Cardiff
	Seyler, C. A.	Nelson Terrace, Swansea
	Shaw, Dr. J. E.	23 Caledonia Place, Clifton
	Shepherd, G. D.	Gresham Chambers, Kingsway, Cardiff
A	Sinnott, Jas.	15 Beaufort Road, Clifton
A	Smallcombe, W. A.	62 Greenbank Road, Easton, Bristol
A	Smith, Miss A. M.	70 Pembroke Road, Clifton
A	Smith, Miss E. J.	70 Pembroke Road, Clifton
P	Smith, G. Munro, M.R.C.S., L.R.C.P.	18 Apsley Road, Clifton
	Smith, D. Munro	18 Apsley Road, Clifton
	Smith, H. C.	13 Acraman's Road, Southville, Bristol
	Smith, W. A., M.B.	70 Pembroke Road, Clifton
A	Spoor, Miss Vera E.	The Hydro, College Green, Bristol
	Stanton, D. W.	The Ferns, 42 Alma Road, Clifton
	Stanton, Mrs.	The Ferns, 42 Alma Road, Clifton
	Stephens, A., M.I.E.E.	The Firs, Easton-in-Gordano
	Stewart, D. McDonald, F.G.S.	25 Woodstock Road, Bristol
	Stoddart, F. W., F.I.C., F.C.S.	Grafton Lodge, Sneyd Park, Bristol
L	Strickland, Thompson	13 Victoria Square, Clifton
A	Sturge, Francis	11 Leigh Road, Clifton
P	Tutcher, J. W.	57 Berkeley Road, Bishopston, Bristol
	Underhill, J.	2 Brynland Avenue, Bishopston, Bristol
	Vaughan, P. H.	Redland Hill House, Bristol
A	Wadlow, H. J.	School House, Frenchay
	Walker, Edwin	9 Tyndall's Park Road, Bristol
	Walton, J. C. H.	18 West Park, Bristol
	Waterfall, W. B.	64 Woodstock Road, Bristol
	Webb, R. B.	11 Goldney Road, Bristol
A	Wells, A. E.	38 Henleaze Gardens, Westbury-on- Trym
P	White, Jas. W., F.L.S.	18 Woodland Road, Clifton, Bristol
	White, Mrs.	18 Woodland Road, Clifton, Bristol
P	Wickes, W. H.	7 St. John's Road, Clifton
	Williams, Miss K. I., B.Sc. ...	Llandaff House, 1 Pembroke Vale, Clifton, Bristol
A	Williams, Miss R. L.	12 Henleaze Gardens, Durdham Down, Westbury-on-Trym
	Winwood, Rev. H. H.	11 Cavendish Crescent, Bath
A	Winn, Miss	10 Priory Road, Bristol
A	Wood, Miss K. M.	8 Westbury Park
A	Woodey, E. L.	Hildrop, South Road, Kingswood, Bristol
	Worsley, P. J., B.A., F.C.S. ...	Rodney Lodge, Clifton
	Worsley, Miss I.	Rodney Lodge, Clifton
A	Wright, Miss A. H. M.	4 Buckingham Place, Clifton
	Yabbicom, T. H., M.I.C.E. ...	23 Oakfield Road, Clifton

REPORT OF THE COUNCIL

To December 31st, 1914.

DURING the last year there has been a nett decrease in membership of two.

		Ord. Members.	Associate Members.	Total.
1912	...	85	39	— 124
1913	...	103	49	— 152
1914	...	101	49	— 150

In addition there are 12 hon. members and also about 10 student members of sections only, making a grand total of 172.

During the year the Annual Report and Proceedings were published, representing Series IV, Vol. IV, Part I, and extending over 103 pages, and including 4 plates. This volume was taken to represent the Jubilee Volume of the Proceedings.

The following meetings were held during the year :—

Jan. 22nd, 1914.—Annual Meeting. Presidential address by Miss I. M. Roper, entitled “Historical Associations of Plants.” Specimens were exhibited by Mr. Kemp (Hill’s Herbal of 1812), Mr. Griffith (Life History of Australian Butterflies), Mr. Batchelor (*Euschemon Rafflesiae*), and Mr. White (Monograph on *Symphytum* by C. Bucknall).

Feb. 5th, 1914.—Mr. C. Hunter: “Peat.” Exhibits: Dr. Darbishire demonstrated the splitting of Penyrorsedd roofing slate. Mr. Davies exhibited a monocotyledonous flower, which had come from the Cape in cold storage. Mr. Kemp presented to the Society copies of Lavoisier, Elements of Chemistry, 1796, and Decandolle and Sprengel, Elements of the Philosophy of Plants, 1821.

Mar. 5th, 1914.—Mr. C. T. Gimingham: Henri Fabre, Entomologist and Poet.” Exhibits: Dr. Darbishire, The Ultramicroscope; Mr. White, *Utricularia neglecta* and major from Tadham Moor, and *Calamagrostis epigæos* growing on peat; Mr. Griffiths, Specimens of Wood Argus Butterfly from Algeria; Miss Lucas, a Living Toad.

April 2nd, 1914.—Mr. J. H. Savory : “Caves and Cave Gorges of Mendip.” Exhibits : Mrs. Sandwith, Ophrys Lutea and O. Arachnites in flower, from Mentone. The death was announced of Dr. E. C. Reed, Chili, one of the hon. members, and first Secretary of the Entomological Section of the Bristol Naturalists’ Society, at its foundation, 1864.

May 7th, 1914.—Mr. D. E. I. Innes : “Lakes and Rivers.”

July 19th, 1914.—Annual Summer Excursion to Ashton Park.

Oct. 1st, 1914.—Public Meeting in the Large Hall of the University to hear Mr. Raymond Priestley on “The History of the Northern Party of Captain Scott’s last Expedition.”

Nov. 5th, 1914.—This Meeting represented the Annual Exhibition Meeting. After some preliminary remarks by the President, Mr. Griffiths exhibited specimens showing seasonal variation in butterflies. Dr. G. Munro Smith called attention to the degrees of intelligence exhibited by cats and dogs. Mr. Davies showed some oak spangles. Mr. White had brought some rare plants, and Dr. Darbishire had placed on the table some recent additions to the Botanical Museum.

Dec. 3rd, 1914.—Miss D. May : “The Animal Life of the Sea-Shore.” Miss Roper exhibited a white water lily from Tickenham Moor.

There was an average attendance at the meetings of about 40 members and their friends, but this figure does not include Mr. Priestley’s Lecture, when there was present an audience of 154.

LIBRARIANS' REPORT

For the Year 1914.

DURING the past year 12 members only have borrowed books ; and the number of books taken out has been 75. Of these, nine were still out at the end of the year : while four borrowed in 1913, and ten borrowed in 1912, have not been returned. We would urge those members who have these books not to forget that other members may be wishing to consult the volumes which seem to be so fascinating to themselves.

No volumes have been sent to the bookbinders this year.

We have received, during the past twelve months, from the Corresponding Societies, three bound volumes, and 253 unbound parts of current publications ; and also six parts to complete series of earlier dates.

To the following donors of books, etc., we tender our sincere thanks :—

BRITISH ASSOCIATION for the 83rd Report (Birmingham) 1913.

DR. SYDNEY YOUNG, F.R.S., for "*Philosophical Transactions of the Royal Society*," Series B, Vol. 204, 1914.

ANONYMOUS, Forbes and Hanley's *British Mollusca*, 4 vols., 1853.

F. G. PEARCEY, ESQ., "*Foraminifera of the Scottish National Antarctic Expedition*," 1914.

J. T. KEMP, ESQ., "*Elements of Philosophy of Plants*" (De Candolle and Sprengel), 1821. "*Elements of Chemistry*" (Lavoisier), 1796.

DR. A. B. PROWSE, "*Fifth Report of Botanical Committee of the Devon Association*," 1913.

MONS. CHARLES JANET, for paper on "*Le Volvox*," 1914.

As in former years we have to thank the "*Entomological Section*," B.N.S., for certain parts of the "*Entomologist*" and the "*Entomologist's Monthly*"; and the "*Geological Section*" for various parts of the "*Geological Magazine*."

We have received publications for subscriptions paid to "*The Ray Society*," the "*Zoological Record*," and Taylor's "*British Mollusca*."

There is no alteration in the Exchange List.

ARTHUR B. PROWSE, M.D., *Hon. Librarian.*

IDA M. ROPER, F.L.S., *Hon. Sub-Librarian.*

Jan. 21, 1915.

EXCHANGE LIST.

Ashmolean Natural History Society of Oxfordshire
 Barrow Naturalists' Field Club
 Bath Natural History and Antiquarian Field Club
 Belfast Naturalists' Field Club
 Birmingham Natural History and Philosophical Society
 Bristol Corporation Public Libraries (Subscription)
 Bristol Museum and Art Gallery
 British Association
 British Museum (Natural History), S.W.
 Cardiff Naturalists' Society
 Chester Natural Science Society
 Clifton Antiquarian Club
 Clifton College Scientific Society
 Cornwall, Royal Geological Society of
 ———, Royal Institution of
 ———, Royal Polytechnic Society
 Cotteswold Naturalists' Field Club
 Ealing Scientific and Microscopical Society
 Edinburgh Geographical Society
 ——— Royal Botanic Society
 Essex Field Club
 Geological Society of London
 Geologists' Association
 Glasgow Geological Society
 ——— Natural History Society
 ——— Philosophical Society
 Hertfordshire Natural History Society and Field Club.
 Liverpool Geological Association
 ——— Geological Society
 ——— Literary and Philosophical Society
 ——— Science Students' Association
 Manchester Literary and Philosophical Society
 ——— Microscopical Society
 ——— Museum Library
 Marlborough College Natural History Society
 North Staffordshire Field Club
 Norfolk and Norwich Naturalists' Society
 Nottingham Naturalists' Society
 Plymouth, Marine Biological Association of the United Kingdom
 ——— Institution and Devon and Cornwall Natural History Society
 Quekett Microscopical Club
 Royal Irish Academy
 Royal Microscopical Society
 Rugby School Natural History Society
 Somersetshire Archaeological and Natural History Society
 Torquay Natural History Society
 Woolhope Natural History Field Club
 Yorkshire Geological and Polytechnic Society
 ——— Naturalists' Union
 ——— Philosophical Society

Our "Proceedings" are sent as a free gift to :—

British Museum Library
 Cambridge University Library
 Dublin, Trinity College Library
 Edinburgh, Advocates' Library
 Oxford, Bodleian Library
 Patent Office Library, London

AUSTRIA.

Wien, K. K. Naturhistorisches Hofmuseum

FRANCE.

Lyon, La Société Linnéenne de
University of Rennes

GERMANY.

Cassel, Verein für Naturkunde
Frankfurt a/O.—Naturwissenschaftlicher Verein für den Regierungs-
bezirk F. a/O
Giessen, Oberhessische Gesellschaft für Natur-und Heilkunde
Halle a. Saale, Preussen, Kaiserliche Leopoldinische-Carolinische
Deutsche Akademie der Naturforscher
Hamburg, Verein für Naturwissenschaftliche Unterhaltung

NORWAY.

Det Kongelige Norsk Universitet i Christiania

SWITZERLAND.

Société Vaudois des Sciences Naturelles, Lausanne
Zürich, Naturforschende Gesellschaft in Zürich

AUSTRALIA.

Australasian Association for the Advancement of Science
New South Wales, Geological Survey
_____, Royal Society of
Queensland Museum, Brisbane
Victoria, Royal Society of

CANADA.

Canadian Institute, Toronto
Hamilton Scientific Association
Nova Scotian Institute of Natural Science (Halifax)

INDIA.

Agricultural Journal of India
Agriculture, Imperial Department of
Geological Survey of India, Calcutta

MEXICO.

Mexico Sociedad Científica

UNITED STATES.

American Museum of Natural History, New York
Augustana College, Rock Island, Illinois
Boston (Mass.) Natural History Society
Brooklyn Institute of Arts and Sciences (Coldspring Harbour)
California, University of, (Berkeley)

Californian Academy of Sciences
 Cincinnati Natural History Society
 ———— Lloyd Library
 Colorado College (Colorado Springs)
 ———— University (Boulder)
 Connecticut Academy of Arts and Sciences (Yale University
 Publications)
 Denison Scientific Association, Ohio
 Essex Institute, Salem (Mass.)
 Illinois, University of, (Urbana)
 Indiana Academy of Science
 Michigan Academy of Science
 Missouri Botanical Gardens
 Missouri, St. Louis, Academy of Science
 New Mexico, University of, (Albuquerque)
 North Carolina (Chaple Hill) Elisha Mitchell Scientific Society
 Ohio State University (Columbus)
 Oklahoma State University
 Philadelphia Academy of Natural Sciences
 Philadelphia Wagner Free Institute of Sciences
 Smithsonian Institution, Washington
 Tufts' College (Mass.)
 United States Geological Survey of the Territories, Washington
 ———— Natural Museum, Washington

URUGUAY.

Montevideo, Museo Nacional de

ARTHUR B. PROWSE, M.D.,

January, 1914.

Hon. Librarian.

The HON. TREASURER in Account with the BRISTOL NATURALISTS' SOCIETY.

DR. GENERAL ACCOUNT FOR THE YEAR ENDING DECEMBER 31st, 1914. CR.

To Entrance Fees	...	£	s.	d.	By Zoological Society of London—Subscriptions (2)	£	s.	d.
Subscriptions—Ordinary...	...	..	0	15	0	3	0	0
Do. Associates	...	...	31	0	0	...	...	...
Arrears	...	...	7	15	0	...	...	...
Subscriptions paid in advance	...	...	2	15	0	...	...	...
Sale of Proceedings	...	...	2	10	0	...	...	...
Sale of Tickets—Mr. Priestley's Lecture	...	...	0	5	1	...	...	...
			...	6	10	0	...	...
			Total Receipts	£51	10	1		
Cash at Bank, per last Account	...	...	24	1	2	...	...	...
Cash in hands of Hon. Treasurer, per last Account	...	...	2	12	0	...	...	...
Do. Hon. Librarian,	...	...	2	3	4	...	...	...
Balance due to Hon. Treasurer	...	...	2	3	3½	...	...	...
			£82	9	10½			

Audited and found correct,

ERNEST H. COOK, } Auditors.
CHAS. BARTLETT, A.C.A. }

Bristol, January 29th, 1915.

GEOLOGICAL SECTION.

THE present number of members is 53. During the year the President was absent for some months when he attended the meeting of the British Association in Australia.

At the commencement of the war the newly-appointed joint Honorary Secretary, Mr. D. E. Innes, joined the new Army, so the Section was deprived of his services.

Prof. S. H. Reynolds, M.A., Sc.D., F.G.S., was re-elected President, and B. A. Baker, F.G.S., Hon. Sec. for the year.

There have been eight meetings when the following papers were read :—

23rd January.—“The Scenery of the N.W. and Mid-Wales and Wye Valley” (illustrated by lantern slides), by L. Richardson, F.G.S.

February.—“Oil Deposits,” by A. P. Bacon.

19th March.—“Earth Movements,” by G. M. Tincknell.

23rd April.—“Geological Sections through the Andes of Peru,” by J. A. Douglas, M.A., F.G.S. (illustrated by maps and lantern slides).

23rd May.—“Fifty Years’ Geological Research in the Bristol District,” by Prof. S. H. Reynolds, M.A., F.G.S.

15th October.—“Founders of Geology,” by F. S. Wallis.

19th November.—“Some Thoughts Concerning River Development in S.W. England and Wales,” by L. Richardson, F.G.S.

17th December.—“Some Ancient Mountains” (illustrated by lantern slides), by Dr. T. T. Groom, F.G.S.

The average attendance at seven out of the eight meetings was 23, which is an improvement on the previous year.

The Financial Report shows receipts amounting to £3 7s., which is a considerable falling off from previous years. The expenditure amounts to £4 14s. 8d., so that had there not been a balance of £2 1s. 5d. brought forward from last year, the Section would have been in debt. As the accounts now stand there is only 13/9 carried forward to the good for next year. The reason of the receipts being so small is owing to the fact that there are 21 subscriptions unpaid (some of these have been paid since the accounts were closed), and I regret to find that many of those who have not paid have left Bristol.

B. A. BAKER, *Hon. Sec.*

ENTOMOLOGICAL SECTION.

THREE Meetings only and no Excursions were held during 1914, and new members are urgently wanted to make the Section a success.

January 16th.—Exhibits. Mr. Griffiths, Lepidoptera from Ta-tsien-lou, W. China, at an elevation of 8,400 feet. These included many specimens captured by the Jesuit Fathers, one specimen of *Melanargia halimede* being taken by the Bishop, Mgr. Beit. Mr. Smallcombe, some Indian Lepidoptera. A discussion on protective resemblance took place when Dr. Rudge produced a letter from the late Dr. Alfred Russell Wallace, written in March last.

February 26th.—Mr. Charbonnier communicated a paper, "Notes on Sexual Dimorphism in the *Sciarinae* or Fungus Gnats." There are six different sexual forms in this small group, and the following species were exhibited to illustrate the paper: *Sciara semialata*, a new species, and *Peyerimhoffia scabiei*. A new species of *Tipulidæ*. *Triogma trisuleata*, from Blairgowrie, Perthshire, was also shown. Hon. Secretary exhibited a variable series of *Smerinthus populi*, including dark, pale, banded and pink varieties. *Mymas tilia*, one spot, banded, and assymetrical forms, also bred specimens of *Colias edusa* var. *helice*.

November 3rd.—Exhibits. Mr. Griffiths, numerous British and foreign Lepidoptera, including the rare blue ♀ and brown ♂ of *Caudalides Cyprotus* from Queensland. Hon. Secretary, Diptera, viz., *Criorrhina berberina floccosa* and *oxyacanthæ*, *Myiatropha florea*, *Ptilonota guttata*, all from Portishead, also *Empis tessellata* killing *Dilophus fibrilis*.

CHARLES BARTLETT, *Hon. Sec.*

Members.

G. C. Griffiths, 3 Leigh Road, Clifton, *President*.

Dr. C. King Rudge, 145 Whiteladies Road, Clifton.

A. E. Hudd, F.S.A., 108 Pembroke Road, Clifton.

H. J. Charbonnier, Olveston, Glos.

Chas. Bartlett, 8 Woodhill, Portishead, *Hon. Sec.*

ANNUAL ADDRESS.

“PERMANENCY IN THE GROWTH OF PLANTS.”

BY THE PRESIDENT—MISS IDA M. ROPER, F.L.S.

TO-NIGHT you have been good enough to elect me to be your President for the third year in succession, and I thank you for the honour you have done me by your decision, and for the kind support which I have constantly received from each individual member. The Society has continued unostentatiously to take part and stimulate the general interest in Natural History, in much the same way as in the past.

The Annual Summer Excursion was held in the grounds of Ashton Court, and this visit is of more interest now, because Lady Smyth, the owner of the beautiful gardens and the museum adjoining, has been taken from our midst during the last two months. Although not a member of this Society she and her husband had great interest in Natural History, as shown by what they have done for the city at the Bristol Museum.

In the autumn, when the effects of the terrible War called away the help of so many of the members from scientific pursuits, it was still possible to give to Mr. Raymond Priestley a hearty welcome on the occasion of his visit to his old University. He came, as you remember, from his military duties to tell us about his exciting adventures on the Antarctic continent, and we were glad to show him by our presence, that we extended our interests as far as that distant region.

To-night it may be better to come back to more local districts, and although the War will obtrude even into the pursuits of the Naturalist, it may be possible to consider one aspect that will not be disturbing. The methods of modern warfare have made it necessary to dig trenches, and to form camps for troops around much of our coast-line, which is always the favourite hunting ground for the student of Natural History. That some injury will be done to many of the plants and insects flourishing in such places is certain, but if we examine what has happened to the native flora over a long period in the past it will be found that Nature has endowed her children with such a permanency of growth that no fear need be felt that our happy hunting grounds will suffer for any length of time from this present disturbance. As evidence of this belief I should like, therefore, to call your attention to-night to some facts, which may bring out more clearly this “Permanency in the growth of plants.”

In wandering about England and giving a thought to Nature in the different spots visited, we are accustomed to recognise that certain plants are likely to be found under similar conditions. These similarities may be due to the soil being of the same formation, such as limestone, granite, etc., or to the presence of moorlands, sheltered sunny slopes, or what not; or it may be

due to the sites being natural ground untouched for centuries by cultivation, or, on the contrary, to the remains of former husbandry in times long ago. In other words, in similar spots of whatever nature, we expect to find, if not the same species of plants, then those that are closely allied.

It is a big subject to examine, but a peep into one little corner of it may be, perhaps, of interest and worthy of thought.

Certain observations in one's own experience on visits to ancient monasteries, and the dwelling places of hermits seem to show that similar plants are often met with in such limited areas in so marked a manner, as to lead to further comparisons, and these in their turn to the feeling that there is in hardy species a permanency of growth around one spot that is remarkable. It is to be remembered that in considering these monastic domains we are dealing with the homes of human beings who planted for a purpose, and therefore cultivated plants to suit their needs, and without consideration whether the positions were suitable or not for the growth of kinds they wanted, and again, that wanton destruction and neglect have since then repeatedly passed over those tracks of land. Yet with both these hostile factors at work, the same kinds of plants have survived such treatment in those places, and still to a limited extent hold their own year after year during the long period of over 280 years, since the abolition of the religious houses in England. In observing such plants we may well feel that in this century we must be looking at the direct descendants of the very herbs that were grown with loving care by the monks of long ago, and can realize that there is a permanency about Nature's work, which may be at times overlooked. There is no need to go far afield for examples to illustrate this aspect, although its truth becomes more evident when a number of such habitats is compared.

Amidst the vales of Yorkshire are the ruins of several old Abbeys, founded by monks who believed that to make "the desert rejoice and blossom as the rose" was one of the great callings of man on earth, and who accordingly chose what were then deserted wilds for the sites of their habitations, and there to this day, in spite of so much human work about them from the time they were abandoned, are to be seen patches of the Stinking and Green Hellebores, the Deadly Nightshade, *Aristolochia*, Goutweed, and the White Horehound, all of them remnants of the infirmary garden attached to these monastic buildings. The two Hellebores used to be employed in medicine for internal diseases. They are amongst the earliest of flowers to come into blossom in the spring, and in places where they are met with about here are looked upon as products of cultivation by the housewife of long ago. The Deadly Nightshade seems to have been grown by the monks for the purpose of quieting sufferers in the delirium of fever, but of late years only a few plants of this species are to be found in any one spot, the others having been

carefully destroyed by the landowners on account of the presence of their exceedingly poisonous but tempting-looking fruits. It is a handsome plant and until recently could often be seen in the woods to the north of Bristol. The Goutweed, as its name implies, had a reputation for the alleviation of gout, and the aromatic leaves of the White Horehound were used for the same purpose.

In the same way it is the common experience to find the crumbling walls oftentimes clothed with the wall pellitory, and brightened by the gay blossoms of the wallflower, the clove pink, and the hairbell.

"Mid ruins tumbling to decay,
Bluebells their azure hues display,
Still freshly springing,
Where pride and pomp have passed away;
To mossy wall and turret grey,
Like friendship clinging."

Coming nearer to Bristol, we have spots that have gone through similar treatment such as Tintern, Keynsham, Woodspring, and Glastonbury, besides those where hermits chose to fix their lonely cells; and amongst the ruins of these famous buildings flourish the self-same flowers.

In order to understand why like plants got there it may be worth while to glance at the period when regular cultivation in fenced ground was carried on of many herbs which were originally indigenous, or introduced in Roman times, and are now again regarded as wild.

When the religious people established a new Priory or dwelling place in the 11th and 12th centuries, one of their first works was to lay out gardens adjoining. The object was to produce herbs for their daily food, and there was scarcely a single enclosure for flowers for the sake of decoration. On the other hand, however, some of their medicinal plants were grown in large clumps such as the single Rose, the Peony, the Violet, and the Poppy, which prevented gay colours from being altogether wanting.

A couple of centuries later when traffic was passing freely between the English monastic houses and those in the North of France, and even in Rome, the number of different sorts of cooking vegetables had still increased only to a small extent, but the chief point to be noted was the difference in the quality, and that the kinds of aromatic herbs had become more varied. These latter were used for stuffing, and for adding their pungent flavour to the quantity of salted meats that were necessarily eaten when, in the absence of hay and green fodder, large numbers of cattle and sheep could not be kept alive in the winter.

The tastes of the better classes were formed on the recipes of the Romans, who insisted on strongly seasoned dishes at their tables, and of meats mingled in a manner that seems to the

modern palate to produce nauseous messes. The making of these dishes required onions and leeks, parsley, thyme, and many similar herbs, or, on the other hand, in order to counteract the strong flavours of these it was usual to serve also conserves of acid fruits, such as the crab apple, the wild cherry, the bullace, and the hips of the dog-rose.

The servitors, however, of the monasteries, the labourers on the farms, and the poorer classes generally, including the travellers, could not obtain these luxuries except on rare occasions, and for the food of these people who comprised the mass of the population, fresh and dried vegetables were the chief commodity. That is the reason why we find so many kinds of herbs cultivated for their use, such as we regard only as wild plants, and to which the name of vegetable hardly applies in these days. There were beans of some kind, but the chief herbs grown were comfrey, yarrow, garlic, plantain, nettles, betony, teasle, and others, as well as aromatic plants like sage, mint, vervain, marjoram, tansy, parsley, the fleshy sedums, wormwood, basil thyme, hyssop, primrose, and many similar ones. Nor must fennel, periwinkle, Alexanders, and the hawthorn be omitted, because there is no doubt these were very extensively cultivated as staple foods or to mingle with the meats. From an excellent book on "The Feate of Gardening,"* written about 1440, we find the names of all these plants and many others, making a total of nearly 100, which were freely grown in England as articles of food.

During the centuries, when continual struggles were taking place between the Barons and the King or against continental foes, the religious houses had been left for the most part in peace and unmolested, so that from year to year the same kinds of herbs were grown with but little change.

Flowers were not sought after for the sake of their beauty as with us, but were added from time to time to the pleasure gardens of the richer houses in order to supply material for the adornment of the shrines, to form wreaths for the officiating priest on feast days, and to deck the lighted candles at the altar, or to place on the graves of the departed. This custom is alluded to by Shakespeare, who mentions the "pale primrose," "the azur'd harebell," and "the leafe of eglantine," amongst the "fairest flowers" to be laid on the "sad grave."†

The yellow flag and purple irises and tall white lilies were amongst the favourites grown, all known by the name of "lilies" in those days, the campion, St. John's wort, columbine, mallow and crane's bills, together with lavender, rosemary, and thyme. With these herbs and flowers being continually planted at fixed

* By John Gardener, MS., Trinity College, Cambridge.

† *Cymbeline*, Act iv. Sc. 2.

spots in the country it may not be wondered at that some of them, perhaps many, should survive thereabouts down to our own times. And this is no doubt the origin of the similarity of the survivals at the different sites to which attention has been called.

And yet at the great religious houses how few kinds of these plants manage to remain when the destruction of the monasteries and hermitages has been so complete. And why? Because those who came afterwards found the well tilled sites so tempting to settle upon and to carry out the more modern forms of cultivation, that the gardens were naturally the first parts to feel the changed conditions, to be followed in so many instances by the destruction of all the building to supply stones for other dwelling houses.

In this way all traces are lost of the gardens at Glastonbury; at Wookey, where the Abbey of Wells is known to have had a flower garden; at Gloucester, with its vineyards; at Tintern, and at many others. Under such destruction and with such tempting soil it is only just a few plants that still remain about the ruins that can be reasonably thought to have their origin dating back to the cultivation of the monks. These few serve to show that the permanency of growth of many more around fixed spots would have been maintained but for the interference of man over long periods, and a way to test it further is an examination around the abodes of hermits, where the ground has reverted to its wild state after the departure of the ancient occupants. In our own neighbourhood we have several sites occupied at one time by hermits, and these will serve the purpose of proof.

If we examine the top of Brandon Hill, which was a heap of rocks until 100 years ago, or the sandstone cell between Redcliffe Church and the Harbour, it must be acknowledged we do not get any help, nor should we fairly expect any in the midst of a large city, although in the heart of Edinburgh plants of *Lychnis viscaria* have persisted in a wild state for many generations. If we look, however, at St. Vincent's Rocks or at the Steep Holm we find that they have received a different kind of treatment.

History tells us that on the precipitous slopes of St. Vincent's Rocks a series of hermits had their dwelling place, and as all of them in England belonged to the Order of Austin Friars they lived on alms, and their only property was the cave or cell in which they dwelt. Small gardens would be, of course, attached for the supply of vegetables, and supplicants at the shrine, or passers-by provided the necessary bread. In those centuries the face of the cliff had not been quarried away, and there would have been a wide ledge outside the mouth of the cave with a path leading to the larger slope that stretched from the western end of the hill down to the river's bank below the present bridge, to the ferry that crossed thence to Somerset. Canon Rawnsley, who is so well known in Cumberland for his efforts to preserve

for the public the beauty spots of England, lived at Clifton in his early days, and whilst there described in verse his thoughts about the Hermit of St. Vincent's Rock—

“The full tide taught him calm ; at ebb he heard
The hurrying streams his indolence rebuke !
The cave's cool drip of water was his clock !
The birds to Matins called, to Vespers led ;
And as he knelt sweet fragrances were shed
From those gold censers blowing on the rock !
So with imagination for his guide
The hermit lived, and loved his God and died.”*

“The gold censers blowing on the rock” is a poetic reference to the yellow wallflowers which are so abundant on the rocks in Spring-time.

These same hermits left their mark on the rocks by the pottage herbs they grew for food, which have survived down to our own days.

Mention has been made of the first real book on Gardening in England published about 1440, and out of the 100 plants named as worthy of growth there are to be found no less than *thirty-five* still flourishing on St. Vincent's Rocks, many of them, and perhaps all, descendants of the hermits' garden. This number of thirty-five plants is given on the authority of the “*Flora of Bristol*,” where they can be found set out in their botanical order.

These Rocks are of limestone with a very thin layer of soil on top, and around Bristol there are many similar formations, of which may be instanced the downland above the Cheddar Gorge, and the upper slopes of the Cadbury ridge towards Clevedon. On these spots there is not to be found anything like the wealth of different kinds of plants such as St. Vincent's Rocks afford. Should not the conclusion be drawn that our particular stretch of downland owes its pre-eminence for the variety of wild flowers to the permanency with which they have survived from the hermits' cultivation in the past ?

A few words about these plants may be of interest. Amongst them are those known to be some of the culinary herbs used in the making of salads and of sauces in monastic times. The chief of these found on the Rocks is the large Umbelliferous plant named by us “*Alexanders*,” and distinguished botanically as “the pot-herb *Alexanders*.” Of late years its growth has increased in such quantities as to make it a conspicuous sight in May when its yellowish-green flower-heads rise above the bright green of its foliage. Fortunately it dies down early in the summer, and in this way makes room for the more lowly flowers that follow in succession. *Alexanders* was eaten, both boiled

* *Bristol Sonnets*, 1877, “Pleasures of Imagination, or The Jackdaws above Ghyston Cave.”

and as a salad until the 17th century, when celery, which it closely resembles in appearance, was introduced into England by the Italians, and caused it thus to go out of favour.

The young leaves of the purple betony, as well as those of the hawthorn and the hazel, and the fronds of the hartstongue and other ferns, were, in their season, in constant use in the kitchen. Wild Parsley, still flourishing on the lower slopes of the Rocks, was used in the seasoning of broth, and Shakespeare mentions it as an ingredient for the stuffing of rabbits.*

Sauces of all kinds were very popular amongst the poor, and the hermits would, therefore, have needed and gathered the acid leaves of the Sorrel, or the pungent ones of the Mint, to flavour their otherwise tasteless vegetables, whilst those of the Fennel would have found special favour to mingle with the boiled fish and to garnish the dishes on feast days. Fennel is another of the survivals from the hermits' herb-garden which remains vigorously established above the entrance to his cave, for its tall stems of bright yellow blossoms and deeply divided feathery leaves still add colour to the spot. Fennel was also largely used in stews to give flavour to the many dishes, together with such aromatic herbs as Marjoram, Yarrow, Basil Thyme, Sage, or Wild Clary and Vervain, which were boiled down and added as the taste of the cook suggested. The little yellow Stonecrop served its turn to be kept in pickle and eaten with oil and vinegar as a tasty savoury, and in this way many other uses might be recalled for the remaining herbs which still find in the 20th century a permanent home on St. Vincent's Rocks.

It is interesting to note that the hermits of St. Vincent do not appear to have cultivated plants which were in those days deemed necessary for physic, but perhaps this is not to be wondered at when we recall the healthy spot they had chosen for their dwelling places. At the same time some of the culinary pot herbs already mentioned possessed medicinal qualities which would not be lost sight of when sailors or travellers needed help.

Another site of an hermitage in the West of England is on the Steep Holm, where a chapel was established by a few hermits driven thither from Wales, and remained for many centuries. On a short visit to the island during the past year certain of the herbs which flourish on St. Vincent's Rocks were noticed about the ruins on the summit, and may be the last survivals of the monkish garden known to have existed somewhere on the island. The two plants associated with this garden that have not succeeded in surviving elsewhere are the entire-leaved Peony and the wild Leek, and this deserted island of the Severn Sea is now the only home for these plants which were constantly mentioned as worthy of cultivation in the physic gardens adjoining the

* *Taming of the Shrew*, Act. iv. Sc. 4.

infirmary of the other monastic houses. The hermits were fortunate to introduce a variety of Peony that could flourish on rocks always exposed to the salt spray, and this hardiness has helped the plant to maintain its position down to the present time, and to give to the neighbourhood of Bristol the opportunity to claim that one more English wild flower grows within its narrow borders, and in no other part of the kingdom.

Another plant that would have been kept in cultivation on the island is the Samphire, which still clothes the surface of the rocks facing the Channel. Its fleshy leaves are specially adapted for life in the sea air, and when pickled was a favourite relish with those monks who had to find their food in situations near the sea shore.

On some other occasion it might be worth while to consider whether the many aromatic herbs that grow so freely about the neighbourhood of Tickenham Hill may not in some way owe their existence to an ancient monastery which at one time existed there; but in calling your attention to the flowers that still adorn St. Vincent's Rocks a new interest may have been aroused in that well-known and ever attractive outlook, and may bring home to some of you the fact that the richness and diversity of its flora, as admitted by botanists from all parts of the kingdom, may indeed be due to the cultivation of pot-herbs by the hermits of olden time, and brought down to us by the permanency with which those herbs cling to their place of growth when left to the loving care of Nature.

January 21st, 1915.

Account of the General Meetings and the Annual Meeting of the Society from January 22nd, 1914, to December 2nd, 1914.

The following account has been compiled by the Secretary, but the Reports of the Meetings are due to the Reporting Secretary, Mr. J. Kemp, whose reports to the papers thus obtain a more permanent place. There are but few alterations as compared with the form in which the reports appeared in either the *Western Daily Press* or the *Times and Mirror*.

THE 51ST ANNUAL MEETING.

January 22nd, 1914.

(*Bristol Times and Mirror*, Jan. 26th, 1914).

The Bristol Naturalists' Society held its 51st annual meeting at the University. The Council and officers were re-elected for the ensuing year, Miss Ida M. Roper, F.L.S., being the President for the second time, and Dr. O. V. Darbishire the Honorary Secretary. Messrs. Bathurst Hony, Savory, and Robson were elected ordinary members, and Miss Lucas an associate.

Mr. J. T. Kemp showed The Family Herbal, issued in 1812, in fortnightly parts, by Sir John Hill, M.D. Mr. G. C. Griffiths showed several Australian butterflies, and made special reference to *Euschemon rafflesiae*, a very rare insect which he had hoped to prove to be a real butterfly, although it had characters pertaining to the moths. Mr. J. W. White congratulated Mr. Cedric Bucknall on the critical monograph lately written by him on the genus "Symphytum," and published by the Linnean Society. He said it was doubly interesting because it was prepared by a past Vice-President and was founded on local plants.

Miss I. M. Roper then gave her presidential address on "Some Historical Associations of Flowers."

(N.B.—Miss Roper's annual address is printed in full in the last number of the Proceedings).

THE 439TH GENERAL MEETING OF THE SOCIETY.

February 5th, 1914.

(*Bristol Times and Mirror*, Feb. 9th, 1914).

At the last meeting of the Bristol Naturalists' Society Miss Roper (President) presided. The Report of the Council for 1913 was read by Dr. Darbishire showing a net increase of 28 members, which Miss Roper regarded as very gratifying. Dr. W. A. Smith, Hon. Treasurer of the Society, reported receipts amounting to

£53 11s. 8d., being an increase of £3 14s. 7½d. The expenses of the year amounted to £78 12s. 10½d., as against £41 15s. 5d. in 1912. Dr. Smith explained that this increase in expenditure was largely apparent, being due to various accounts, which in previous years had been a year behind in payment, now being paid up-to-date. The Librarian's Report was then read by Dr. Darbishire. In response to the President's request for exhibits, Dr. Darbishire demonstrated the ease with which some roofing slate could be split into thin layers of uniform thickness. Another member exhibited a flower gathered in South Africa and brought to England in the cold storage retaining its freshness.

Mr. C. Hunter then gave a lecture, illustrated with lantern slides, on the subject of "Peat," of which he explained that there were two kinds, viz., dry peat, formed of the roots of heath plants on dry surfaces when the rainfall is small, and wet peat, formed in low-lying situations when the rain is heavy. Of the latter, Sedgmoor is an example. The region has evidence of having once been an arm of the sea, which was eventually shut off by the formation of a barrier from the Bristol Channel, after which the peat began to form. A British village has been discovered built on a foundation of brushwood and protected by palisades. Most probably it was approached by boat. There is a Roman road across Sedgmoor, which is found six feet below the surface at Ashcott. The Abbot's Path from Glastonbury to Bartle, where the monks had a chapel, is buried from two to seven feet. The lecturer showed specimens of different kinds of peat and peat forming plants.

Miss Roper exhibited a photograph of a boat, now in the Taunton Museum, supposed to have been constructed about 250 B.C. A discussion followed, in which several members joined.

A vote of thanks to Mr. Hunter concluded the proceedings.

THE 440TH GENERAL MEETING OF THE SOCIETY.

March 5th, 1914.

(*Western Daily Press*, March 7th, 1914).

At the meeting of the Bristol Naturalists, held in the University on Thursday evening, the chair was occupied by the President, Miss Roper. The minutes having been passed, the Secretary read a letter from Dr. Horne, Kerlegh, Cobham, Surrey, who is preparing a monograph on certain species of *Stellaria*, asking for specimens of *S. graminea*, *S. palustris*, and *S. uliginosa*, from the Bristol district.

Dr. Darbishire showed, by means of the ultra-microscope, the movement of the particles of gold in a colloidal solution of gold

in water. Their diameter is estimated at .000006 millimetre. They are in a state of perpetual motion. Owing to their exceeding minuteness, they can only be detected when illuminated in a certain way.

Mr. White, F.L.S., exhibited a specimen of *Utricularia neglecta*, which he gathered at Tadham Moor last year. He first discovered it as an inhabitant of the Somerset peat moors, near Shapwick, in 1902. Mr. Griffiths, F.Z.S., exhibited specimens of the wood argus butterfly (*Pararge ægeria*) with their bright green pupæ.

The chief business of the evening followed, Mr. C. T. Gimmingham's paper on "Henri Fabre, Entomologist and Poet," in which he dealt with the career and work of that eminent French naturalist, who is still living at the age of 90, having been born near Laon in 1823. He was descended from small farmers, but poverty compelled his parents to forsake the country when he was twelve years old, and to keep cafés in one small town after another. Henri Fabre had a hard time, but managed to acquire a knowledge of grammar, mathematics and Latin, and in 1844 he passed the licentiate examination in mathematics and physics at Avignon. He then settled at Ajaccio, in Corsica, as a teacher. There he studied botany, and a year or two later passed the licentiate examination in natural history. He then began his wonderful discoveries in connection with the life history and habits of certain species of sand wasps, of which the lecturer gave a very interesting account. Fabre then settled at Avignon, where he held a position in the University, which he eventually resigned owing to the jealousy of his colleagues. He enjoyed the friendship of John Stuart Mill, and corresponded with Darwin, but he refuses to accept the Darwinian theory of evolution, or to formulate anything of the origin of species. He has written many books on natural history, combining scientific accuracy with poetical feeling. He still works among insects, studying their habits in his wild garden. The lecturer exhibited cases containing some of the insects mentioned in his address.

Miss Roper thanked Mr. Gimmingham for his scholarly paper. She added that not a single one of Fabre's works was to be found in the Bristol public libraries. Several members then spoke. Dr. Rudge stated that Fabre denied the existence of mimicry among insects.

THE 44TH GENERAL MEETING OF THE SOCIETY.

April 2nd, 1914.

(*Bristol Times and Mirror*, April 4th, 1914).

A general meeting of the Bristol Naturalists' Society was held in the University Medical Library on Thursday, when Miss

Roper, the President, occupied the chair. The minutes were read by Dr. Prowse, in the absence of the Hon. Secretary, Dr. Darbishire. Miss Roper announced the death of one of the hon. members of the Society, Mr. E. C. Reed, who was resident in Chili. Mr. R. M. Prideaux, an entomologist of distinction, was elected in his place. Certain alterations in the Society's laws, which were to have been proposed by Dr. Darbishire, were brought forward by the President and carried. A letter was read from the Selborne Society on the protection of wild plants, to which the Council had replied giving their support, and the Council's action was approved by the meeting. A specimen of *Ophrys lutea* in flower was exhibited by Mr. White. The plant is a native of the South of France and Spain. The President and Mr. White showed volumes of two great works on English wild plants now being published.

The chief business of the evening was a lantern lectures by Mr. J. H. Savory on "Caves and Cave Gorges of Mendip." Mr. Savory began his address by describing the formation of caverns by the dissolving power of water flowing through fissures and lines of weakness in limestone rocks. Diagrams of the course of underground waters from the "swallet hole" where the surface water enters the ground were shown. These were followed by some pictures of stalactites and stalagmites. A picture of the explorer's kit, including rope ladder, ropes, pickaxes, camera, lanterns, flash-light, etc., was followed by many striking photographs taken during the course of actual exploration by Mr. Savory and his party in Eastwater Swallet, Lambs' Lair, Wookey Hole, and other places. Miss Roper congratulated Mr. Savory on his work. A vote of thanks was proposed by Dr. Prowse, seconded by Dr. Munro Smith, and carried with acclamation.

THE 442ND GENERAL MEETING OF THE SOCIETY.

May 7th, 1914.

(*Bristol Times and Mirror*, May 9th, 1914).

The closing meeting of the 1913-14 session of the Bristol Naturalists' Society was held at the University, when the chair was occupied by the President, Miss Roper. The minutes having been read and passed, the election of two associates was announced by the President. The Secretary, Dr. Darbishire, proposed for the second time certain alterations in the laws of Society which being again carried, now come into operation. The President announced that several promising papers for the next session, commencing in October, had been received, and that it was intended to hold another exhibition, similar to that of 1913, in November. She then called on Mr. D. E. F. Innes to read his paper on "Lakes and Rivers," which was accompanied by

a beautiful and instructive series of lantern slides, mostly views of river and lake scenery, illustrating their various types and their origin. Commencing with rivers, Mr. Innes explained how they cut down their channels and frequently alter their courses, and how waterfalls are formed. Some rivers are of immense age, like the Indus and the Brahmaputra, which, cutting as they do through the Himalaya mountains, must have begun their existence before their upheaval and have excavated their channels as fast as the land surface rose. Turning to lakes, the speaker classified them under four heads. First are barrier lakes, when the water has been impounded by a barrier, which may be formed in various ways, such as an avalanche or glacier, a glacial moraine, a landslip, or an accumulation of blown sand. The second class includes true rock basins cut out of solid rock by the passage of glaciers. Many of the Scottish lakes have originated in this way. Other basins have been formed by the removal of underground material, such as beds of rock salt, which is the case with the Cheshire meres. The third class of lakes are those formed by earth movements; it includes the largest lakes in the world, such as the great lakes of North America and the East African lakes. The fourth class are lakes which occupy volcanic craters. Mr. Innes's lecture was listened to with great interest, a hearty vote of thanks being passed, on the motion of the President.

ANNUAL SUMMER EXCURSION OF THE SOCIETY.

July 19th, 1914.

(*Bristol Times and Mirror*, July 21st, 1914).

The Bristol Naturalists' Society had their Annual Summer Excursion on Saturday afternoon, when a party of about 65 members and their friends, under the leadership of Miss Roper (President of the Society) visited Ashton Park. The place of meeting was Bower Ashton Lodge, where the party assembled at three o'clock. On entering the park they were first of all conducted through the fruit and vegetable garden and hothouses by the head gardener. They then proceeded, accompanied by Mr. H. B. Napier (steward of the estate), to the vicinity of the house, where they inspected the ornamental flower garden and conservatories. Some of the fine specimens of trees and shrubs attracted much attention. The party then had a long walk, passing through the deer park to the bungalow near Beggarbush Lane, where tea was provided. The deer were seen to great advantage in the open ground. After tea votes of thanks to Lady Smyth for her kindness in permitting the Society to visit the park, and to Mr. and Mrs. Napier for their part in facilitating the success of the day, were proposed by Dr. Shingleton Smith

(the oldest member of the Society present), and seconded by Dr. Harrison. Before dispersing the party spent some time in the museum in the bungalow, which is noted for the magnificent collection of birds it contains. The visit was arranged by Miss Roper, with the assistance of Mr. C. J. Hodgson.

THE 443RD GENERAL MEETING OF THE SOCIETY.

October 1st, 1914.

(*Bristol Times and Mirror*, Oct. 2nd, 1914).

Mr. Raymond Priestley, who was a member of the expedition which went in 1910 under Captain Scott, to carry out scientific work on the Antarctic Continent, gave a delightful lecture at Bristol University on "The History of the Northern Party of Captain Scott's Expedition." The lecturer, a native of Tewkesbury, was formerly at Bristol University, but is now training at Cambridge as a wireless signaller, and will shortly go to the war. The lecture was under the auspices of the Bristol Naturalists' Society, and Miss I. M. Roper, F.L.S., its President, was in the chair.

The President said they were met to hear Mr. Priestley give some account of his experience during the last expedition to the South Pole, organised by Capt. Scott, who left England in 1910. Mr. Priestley scarcely needed an introduction. She might remind them, however, that while he was still a student at Bristol University he was chosen, on account of his great scientific abilities, to be a member of an expedition to the South Pole, in which he proved such a success that he was again selected for the post of geologist on the scientific staff of Captain Scott's expedition. Inasmuch as Mr. Priestley would speak about a part of the world which none of them knew much about, they would listen with interest and enjoy what he would tell them.

The lecturer told the audience that he went in 1910, in conjunction with Capt. Scott, with a scientific party to explore a district covering 500 miles in South Victoria Land. The party consisted of himself, Commander Campbell, Dr. Levick, and Seamen Abbott, Browning, and Dickason. Speaking of the Antarctic Continent, to which they went, he said that most of it was a plateau of from 6,000 to 10,000 feet above sea level, which would give them some idea of the difficulties of entering such a land. He gave an interesting account of the journey south in the Terra Nova approaching the Antarctic and presented portraits of the chief personages of the expedition. The ship was a wooden one because in was less liable to be damaged by pack ice. Having established Capt. Scott in his winter quarters, at Rose Island, he (the lecturer) and his little party went further to the east. They tried to get ashore at King Edward VII. Land, but

were unable to do so. They went further, intending to land on the barrier, but there they found Amundsen, and had to turn back. Finally they got ashore at Cape Adare, 500 miles to the north. They were left there on February 8th, 1911 by the *Terra Nova*, which arranged to call for them on about Jan. 8th the following year. The lecturer, by means of slides, explained some of the difficulties encountered. The velocity of the wind sometimes reached 100 miles an hour. They spent the winter tolerably pleasantly, with plenty of amusements, food, and occupation. They did a good deal of sledging, and met with many adventures. Mr. Priestley showed pictures of animals, birds, and fishes, and narrated some amusing and instructive incidents. When the *Terra Nova* returned it carried the little party about 300 miles to Evan's Cove for a six weeks' sledging journey, with just sufficient food for that period. They travelled many miles, and made a survey of the country. At the end of the time when they were to have been picked up by the vessel she could not reach them, as there was 18 miles of pack ice, which prevented the ship reaching them, and there was ten miles of open water, which prevented the party reaching the ice, and the vessel went away. The party had to remain about nine months without shelter or reserve of food. And all that period there were not twenty-four hours' calm weather. Storms raged the whole time. The little food they had they economised with great care, and eked out an existence with seals, the stomach of one of which furnished them with 36 fish. For shelter they hollowed out a snowdrift, and made a carpet of seaweed. At the end of September, 1912, they were able to start a journey down the coast to join up with the main party, and after going 230 miles, living on half-rations, they reached their destination just after an expedition had set out to recover the body of Captain Scott. They waited on Ross Island until the *Terra Nova* returned home.

The slides with which the lecture was illustrated were exceedingly good, and brought to the sight a vivid idea of the nature of the country and the adventures of the party.

Professor Lloyd Morgan, in proposing a vote of thanks to the lecturer, expressed regret at the inability of the Vice-Chancellor to be present. The way in which the audience had listened to the lecture had already shown Mr. Priestley that they most thoroughly appreciated the way in which he had put before them such an extraordinarily interesting story. The name of Priestley was somewhat honoured in that University. The lecturer himself was a student under his friend and colleague, Professor Reynolds; and his brother, now Professor Priestley, was at the University for many years. Hence it was a particular pleasure to him (the speaker) to be present to hear a former University College student speak to them in such a graphic way, and to feel that they had partially trained a man of so much grit. One thing which showed through the delightful humour of his charming and instructive lecture was that there was a good deal

of firm setting of teeth and just worrying through, as Englishmen had a way of doing.

Dr. Tyndall seconded the resolution, and expressed pleasure at having had a small share in the training of Mr. Priestley.

The proposition was enthusiastically carried.

THE 444TH GENERAL MEETING OF THE SOCIETY.

November 5th, 1914.

(*Bristol Times and Mirror*, Nov. 7th, 1914).

The second general meeting of the session was held at the University on Thursday evening, the chair being occupied by Miss Roper, F.L.S., President of the Society. Dr. Munro Smith gave a short address on instances of intelligence in cats and dogs, but the greater part of the evening was devoted to the inspection of some very interesting exhibits brought to the meeting by several members. Mr. G. C. Griffiths, F.Z.S., showed a fine collection of European butterflies, chiefly British, illustrating seasonal variation. Mr. J. W. White, F.L.S., brought specimens of a plant new to the Bristol district, viz., a rush (*Juncus tenuis*), discovered in the Avon by Mrs. Sandwith; also a variety not hitherto named of the sea sharp rush (*Juncus maritimus*). Miss Roper exhibited examples of plants showing abnormal growth of flowers or leaves. They included white clover, in which the floral organs had taken on leafy forms; yellow toad-flax, showing the corolla changed from the usual irregular shape into a regular tube with five spurs; St. John's wort, with the corolla (usually five yellow petals) entirely suppressed; primrose, two variations, viz., one with sepals turned into true leaves, and another with two flowers on the same stalk; cowslip, also two variations, one with two tiers of flowers on the same stalk, the other with the umbel of flowers turned into leaves; together with abnormal forms of honeysuckle, plantain, garlx, willow and hartstongue. Dr. Darbishire showed a selection of botanical specimens from the University collection. It should be added that the above meeting took the place of the exhibition meeting planned by the Society for this session, but which it has been found impossible to hold under existing circumstances.

THE 445TH GENERAL MEETING OF THE SOCIETY.

December 3rd, 1914.

(*Western Daily Press*, December 7th, 1914).

The last meeting for the year of the Bristol Naturalist' Society was held at the University on Thursday night, the chair being occupied by the President, Miss Roper. The minutes of the previous meeting having been passed, Miss Roper expressed her

pleasure at seeing such a good attendance. The first business of the meeting was the nomination of officers and Council of the Society for 1915. The only members' exhibit was a specimen of the white water lily, by Miss Roper. This plant was included in the local collection gathered by Dr. Stevens between 1840 and 1850, but had never been met with since until the present year, when Miss Roper and her brother found it growing in a rhine between Nailsea and Tickenham. The President then called on Miss May to give her address on "The Animal Life of the Seashore," which proved deeply interesting, being illustrated with lantern slides and specimens.

There are, said the lecturer, two main types of beaches, viz., the rocky shore abounding in pools left by the tide, and the flat, sandy beach. Between are every gradation. The rocky coasts abound in animals which inhabit the pools, whereas it is only close to the low water line on sandy shores that animals have their natural habitat, though many interesting species are found among the refuse of the high tide mark. Miss May then gave some accounts of the animal life she had met with among the rocks of the Cornish coast and on flat shores. Among the former she mentioned the sea anemones, two species of which are nearly always found in whelk shells inhabited by the hermit crab, an association which, in some ways, tends to their mutual advantage. Possibly the anemone feeds on the refuse of the hermit crabs' food, while it protects the latter from some enemies. Above the high tide line rock pools of brackish water sometimes occur which are rarely reached by the sea. These often contain species of animals different from the other pools. At Clevedon they abounded in a large crustacean resembling a wood louse. On sandy shores marine worms, such as the lugworm and burrowing molluscs like the razor shell, lived close to the low water line, while in the dry sand sand-hoppers abounded. Large numbers of animal forms were found among the seaweed thrown up at high tide, many of which the lecturer described. They included sponges, hydrozoa (often mistaken for seaweeds), polyzoa, of which the sea mat (*Flustra*) is a familiar example, annelids (including the sea-mouse, *Aphrodite*), molluscs, echinoderms (starfish and sea urchins), tunicata (sea squirts), &c. Eggs of marine animals are very common.

Miss Roper congratulated Miss May on her very comprehensive lecture. Dr. Rudge, after complimenting the lecturer, spoke of a very interesting group of fishes, viz., the pipe-fishes, often found in rock pools. Mr. T. H. Davis added that pipe-fishes were very abundant in Jersey. A hearty vote of thanks to Miss May concluded the meeting.

Bristol Botany in 1914.

BY JAS. W. WHITE, F.L.S.

THE progress of local field-botany during the past year can be described as in all respects satisfactory. Outstanding incidents of importance include an addition to the Bristol list of two species of flowering plants not previously known within our area. Other discoveries—almost if not quite as gladdening as the finding of new plants in the district—have confirmed old records for several rarities, records made long ago by our fore-runners who in describing their gatherings did not always leave the exact directions that would have guided other folk to the localities they noted. And so, for half a century sometimes, their botanical successors have been hunting for those spots, have drawn blank, and it may be have tried to cover their failure by proclaiming that the desired plants must “have died out,” or (to use a frequent expression of one of my old friends when thus thwarted) “have been destroyed by quarrying”; when, as it eventually proved, no quarryings were thereabout!

It will be seen that most of these successes are due to the assiduity of a rising generation of botanists whose good work it is the pleasant privilege of a veteran to welcome and to chronicle in this place. He ventures to believe that these young and active ones will go on working in sympathetic fellowship, and by their efforts keep Bristol botany on the high level it may claim to have attained.

Ranunculus Lingua L. In 1865 Mr. T. H. Yabbicom gathered the Great Spearwort on “Walton Moor” and placed a specimen in the herbarium of this Society. So far as is known to the writer the plant was not again noticed in that neighbourhood until 1914, when it was re-discovered by the Misses Cundall in a peaty ditch, well choked with vegetation, a short distance west of Clapton-in-Gordano Church. There was a fair quantity, extending about 100 yards, but when that ditch in turn is cleared and dug out another lengthy period of scarcity will probably follow.

The small patches of *R. Lingua* that occur in the Bristol district are separated from each other by wide intervals. It is a species that never spreads or scatters itself over large areas even when the surrounding ground appears identical in every respect. Thus, on the great expanse of peat-moor between Highbridge and Glastonbury this plant grows only in one place where last year there seemed to be no more and no less of it than there was forty years ago.

Helleborus viridis L. Miss I. M. Roper has shown me a nice clump in an old orchard near the Severn in Hallen Marsh. This is quite a new locality for the plant.

Aconitum Napellus L. For another most interesting confirmation we are indebted to Mr. W. H. Pullin who found the Aconite still growing in Glen Frome where, it may be remembered, Mr. W. W. Stoddart had described its occurrence nearly half a century before. In June last, when I visited the spot with Mr. Pullin, there were at least a dozen stems on a steep wooded bank above the Frome, in a part of the domain where one could not detect any evidence of planting.

Castalia speciosa Salisb. The late Dr. H. O. Stephens was not accustomed to date his specimens, but we know that the White Water-Lily from Tickenham Moor in his herbarium would not have been gathered later than 1870. In all the years that followed, oddly enough, I do not remember that anyone has mentioned the plant's presence on the moor. Yet it still exists in one of the main rhines, as reported last season by Mr. F. Samson.

[*Roemeria hybrida* D.C. This elegant and fragile little poppy is invariably of alien origin with us—introduced with foreign corn—but its rarity and beauty always arrest attention. Six or eight plants were seen by Mr. Ivor W. Evans on a fowl-run near Baptist Mills; and during the past summer others came up upon a peculiarly productive dust-heap in another direction. At the latter place a number of rare and curious visitors accompanied the *Roemeria*, viz., *Trifolium resupinatum*, *Heliotropium europæum*, *Artemisia Absinthium*, *Onopordum Acanthium*, and *Chenopodium olidum*.]

Reseda alba L. On waste ground near the Palace, Redland, Sept., 1914; Ivor W. Evans.

Hypericum elodes L. Last August I had the satisfaction of at length setting eyes on a mass of this pretty bog plant, hitherto so elusive, on the Glastonbury peat-moor. Mr. T. W. Green had detected it in one or two old pits, probably the locality of Sole and Clark, "towards the eastern end of the moor."

Lathyrus palustris L. As a return in kind for the service just mentioned, I gladly led Mr. Green to the station for this lovely vetchling which I had not visited for many years. As in old days, a number of the plants were barren and bore the broad blunt leaflets described by Mr. D. Fry in my *Flora*.

Saxifraga granulata L. Quite a large patch on a bank of the G.W.R. near Keynsham was observed and identified from the window of a train by Mrs. E. P. Sandwith. A very remarkable instance of plant dispersal by railway traffic. Although a rare species in Gloucester and Somerset it is common in Berkshire and grows there on railway banks, so we may reasonably infer that it has travelled to us from the east. My friend Mr. H. S. Thompson tells me that he has seen it too on a railway bank near Stevenage, Hertfordshire. A capital photograph of the plant as it occurs near Keynsham has been taken by Mr. Ivor W. Evans.

Taraxacum palustre D.C. New to the Bristol flora. Discovered on Yate Common, May, 1914, by Mr. Cedric Bucknall. He considers it a distinct species of Dandelion, an opinion that I share. It appears to be an early flowerer and to continue only a short time. Nothing could be seen of it at the end of June.

Campanula patula L. New to West Gloucester. Discovered by H. W. L. Harford, Esq., on the range of hills near Horton. The plant was stated to occur sparingly and to be much nibbled by rabbits or sheep.

Andromeda polifolia L. The beautiful Bog-bell has latterly become much less plentiful on the Glastonbury peat-moors, for reasons given in *Fl. Brist.* p. 414. It can, however, still be found with difficulty and in small quantity as I saw it in August last, sheltered under bushes of Ling on the edges of old turf-cuttings east of Shapwick Station. But I mention it here chiefly on account of the remarkable confirmation of a statement in *Winscombe Sketches* (1882) that it had grown on Blackdown. In his second book, *A Mendip Valley* (1892), the late Mr. Theo. Compton said the *Andromeda* "had been included in the Flora of our hills, but I have not met with it." As neither I, my friends, nor anyone else apparently, had been able to find it, although the upland boggy ground had been repeatedly examined, I assumed (*Fl. Brist. loc. cit.*) that the report was erroneous. For that imputation I now express regret, since in October last Mrs. Sandwith detected a few little plants near the top of Blackdown, and on November 4, guided by her, I gathered a sprig in flower.

Odontites rubra Gilib. A rare and pretty sport of this species with pure white flowers is persistent and plentiful on a grassy roadside about a mile beyond Downend Cemetery, where it has been known to Mr. H. J. Wadlow for some years.

Mentha piperita L. It is interesting to note that this Mint is not really gone from the locality at Woollard, where it had not been seen since 1887, and had been given up as lost by Mr. David Fry and myself. When Mrs. Sandwith visited the spot last summer it had re-appeared.

Galeopsis Ladanum L. Specimens with white flowers have been gathered between Brentry and Filton by Alderman C. E. S. Gardner.

Scutellaria minor L. We have two new localities for the Lesser Scull-cap, viz., Milbury Heath Plantation, G.; and towards the eastern side of the Glastonbury peat-moor, S. The scarcity of this plant on so large a tract of suitable heath and bog is inexplicable.

[*Chenopodium leptophyllum* Nutt. A North American Goose-foot, closely allied to *C. album*, which has been collected from two rubbish-tips by Miss I. M. Roper.]

Polygonum minus Huds. This rarity still continues at the spot on Catcott Moor where it was observed twenty years ago.

Euphorbia Lathyris L. As a sporadic alien the Caper Spurge has shown itself rather frequently of late. Mr. Ivor W. Evans noted at least 20 fine plants near the Sewage Disposal Works in Stoke Bishop Wood; and he met with others on a railway bank near Keynsham and on a wall at Frenchay.

Narcissus biflorus Curtis. We have a new locality in a meadow on the flats between Portbury Church and the Channel, where Miss Lucas came across five or six clumps.

Lemna trisulca L. and *L. minor* L. These Duckweeds were not actually seen flowering in their native peat-moor ditches; but some fronds were noticed by Mrs. Sandwith to be apparently in bud. These she secured and placed in a basin in a sunny window, carefully removing any small snails and water insects that might do damage by biting off the stamens when they projected, and was presently rewarded with a good crop of both species in flower.

Juncus tenuis Willd. New to the district. Our attention has been directed by Mrs. Sandwith to a quantity of this interesting rush doing well along a riverside path by the Avon below Bristol. The standing of *J. tenuis* as a native British plant seems to be insecure. In the *London Catalogue* it is treated as indigenous, but Druce and others regard it with suspicion. Apart from Don's Scottish records its history in Britain goes no farther back than thirty years or so, though during that period it has become known in a number of widely separated stations. That a plant so distinctly characterised should have been entirely overlooked in all these localities by former generations of botanists is inconceivable, and I have little doubt that good judges will agree that in most cases, if not in all, the plant has been introduced—probably from the United States to begin with, and then when well established in one or two centres its dispersal would not be difficult. In this Avonside instance local botanists are clear that the plant cannot have been present more than three or four years at the outside, and that being so the date of introduction might coincide with the erection of some fixed lights on metal standards that have been placed at various points along the river-bank as aids to navigation. These standards with the lighting apparatus were imported from Belfast, and the supposition is that *J. tenuis*, which has grown for years in Belfast harbour, was included in the material used for packing, and in that way reached the spots where it is now established.

Cyperus fuscus L. None has been seen for several years in the ditches where it was discovered, although searched for repeatedly.

Carex pallescens L. Not a very rare sedge, but is the subject of another acceptable confirmation of an old record. In 1885

Mr. Edwin Wheeler found one or two plants "in an open glade of Leigh Woods." No other person seems to have observed it in Leigh Woods until 1914 when a specimen was brought thence by Mr. Noel Sandwith, also from an open glade.

Carex filiformis L. In August last, under the guidance of Mr. T. H. Green, I saw this slender-leaved sedge in abundance over a small area in the locality recorded by the late Thos. Clark sixty years ago, and only a short distance from the *Hypericum elodes*. The peculiarly restricted occurrence of these and other species is a striking and perplexing feature of the peat-moor flora.

[*Hordeum jubatum* L. This handsome grass, of North American origin, has been gathered on rubbish-tips in St. Philip's Marsh by Mrs. Sandwith, and near Brislington by Miss Roper. It had previously been observed in Kent and Oxfordshire].

Asplenium lanceolatum Huds. In my account of this rare fern (*Fl. Brist.* p. 685) I ventured to anticipate that it would be found in other spots along the course of the Frome. Through the explorations of Mr. W. H. Pullin this has actually proved to be the case. Mr. Pullin has pointed out two spots, higher up the valley, where *A. lanceolatum* grows in fair quantity on precipitous sandstone rocks above the river.

Botrychium Lunaria L. On Barrow Hill, not far from the Jubilee Stone, about a dozen plants of Moon-wort have been shown me by Mrs. E. P. Sandwith.

I regret that this recital of many acquisitions must be accompanied by a tale of losses through the destruction of the old coal canal that formerly conveyed barges from Camerton by way of Radford and Dunkerton to Midford and the Avon. A new railway has lately been constructed along that route and part of its course runs actually in the bed of the old canal. Remaining portions of the canal that still held water have been cut and drained, and are now filled with a rank dry-ground vegetation. The effect of these alterations, unfortunately, is that we are robbed of three good species, viz., *Oenanthe fluviatilis*, *Potamogeton Friesii*, and *Chara contraria*. The two latter may possibly be discovered elsewhere, but there can be little or no hope of the *Oenanthe*.

In conclusion I take the opportunity of correcting an error that crept into my *Fifty Years of Botany in Bristol*, recently published by the Society. I was led to say that *Lunularia vulgaris* had fruited abundantly about our city, whereas I am now informed that this Hepatic, though by no means rare in the district, has not yet been found in fruit. Mr. E. H. Read tells me, moreover, that the Cathedral Close is now "so delicately swept and garnished that no Hepatic can keep its footing there at the present day."

The Natural History of Steep Holm.

STEEP HOLM, which once formed part of the peninsula of Brean Down, is a rocky island of limestone in the Bristol Channel about two or three miles from the coast of Weston-super-Mare, and is a conspicuous object, rising as it does perpendicularly out of the water to a height of nearly 260 feet. It has long been known as an interesting spot from a botanist's point of view, and yet comparatively few of them have ever landed on its shores. Turner, when Dean of Wells in the 16th century, seems to have visited the island, because in his famous Herbal, written in 1562, he speaks of plants growing in a "certain Island between the far part of Somersetshire and Wales." Lobelius, the Fleming, must have landed there soon after, and a century later it is on record that the botanist James Newton went there on behalf of Ray and noted *Allium Ampeloprasum*, one of the special plants that flourish on the heights. In 1773 we know that the Rev. John Lightfoot, a Gloucestershire man, in company with Sir Joseph Banks, paid a visit to the sister islands of Steep and Flat Holm and studied their flora. The first published record of the existence of the celebrated Peony appears to have been made in 1803 by Mr. F. B. Wright, who lived at Hinton Blewett, near Clutton, and that flower and the leak have been from then onwards the great attraction in drawing people to pay a visit to Steep Holm. A complete or exact examination of the island, in order to record its *total* flora as apart from noting endemic species, or the little known plants that are usually associated with limestone soils, appears not yet to have been carried out, or at least there are no such lists on record.

A landing on the little beach is only possible when the sea is fairly calm, and it may be necessary to wait for days together to effect a visit, and this would check a thorough exploration of the many hollows and rocky clefts.

The first account met with is from a visit conducted by Mr. John Storrie, of Cardiff, in 1877, accompanied by three other members of the Cardiff Naturalists' Society, who landed on the island in June and stayed one night at the so-called hotel. He mentions less than 20 plants as worthy of comment. The Cardiff Naturalists, however, got up a larger party of ladies and gentlemen in May, 1883, who spent an afternoon in rambling over the heights. Mr. Storrie was again of the party, and by the help of some members, he compiled a list to form the "Flora of the Steep Holm." The names are given of 149 flowers and grasses, including even the common daisy, but later observers feel the party must have been marvellously successful in obtaining certain flowers which have not come under their notice at the same time of year. On the same visit he mentions four species of land shells and one variety. The next list of plants we have is one compiled by the Rev. R. P. Murray, the author of the

“Flora of Somerset,” who, accompanied by our ex-President, Mr. J. W. White, paid a visit to the island in July, 1891, and published the results of the day’s gatherings in the “Journal of Botany” of that year. A long period of neglect appears to have followed this visit, probably because the farmer who occupied the island did not encourage strangers to land, and because it was realized that there were no special plants of interest to be found there beyond the two or three rarities already known to the general botanist. Certain changes in the occupancy have afforded an opportunity in the last two or three years for visits to be paid with greater freedom of movement, and therefore several British field botanists have spent a day there.

At the end of May, 1914, a party of seven Bristol Naturalists went to the island to study also the molluscs and the insect life. Messrs. A. E. Hudd, C. E. L. Gardner, and Miss Roper confined themselves to the plant life, and their joint observations resulted in a list of 92 flowering plants.

Mr. F. G. Pearcey, as the conchologist, collected some valuable material that has been added to the Bristol Museum, and Messrs. G. C. Griffiths, C. Bartlett, and Miss Nora Ward, studied the entomology.

Full details of their finds will be given by them later in this paper.

BOTANY.—BY IDA M. ROPER, F.L.S.

Mr. Murray, in his account, says that probably the entire vegetation of the island—flowering plants and cryptogams—does not much exceed 150 species in the whole year, and as our list does not include the grasses and was made at the end of May it would seem that our record of 92 species and varieties was a good result for the comparatively short time at our disposal. The weather for some weeks previously had been very dry so that many of the smaller plants were past and over, whilst much of the herbage on the summit had been eaten down by a donkey and several goats, which had the free run of the island. The party was landed on a pebbly beach about 40 yards in length, which is devoid of vegetation except for a few plants of *Beta maritima*, whose fleshy root is able to force its way down to a constant supply of water. The island is about a mile and a half in circumference, and the ascent begins at once by a few steps, and a steep winding path fashioned out of the face of the rock, and leading upwards to the grassy plateau. At the top are the remains of old buildings, and some further distance on is a small dwelling house.

There are no trees on the island, except two or three small sycamores near the landing stage, and the shrubs are all stunted from the force of the wind.

There was reason to think that the *Pæonia corallina* had become very scarce compared with what was known of it years

ago, and it was only towards the end of our day that we came upon a small patch surviving on an almost inaccessible ledge on the face of a cliff. The flowers were, of course, past as it blossoms in April, but there were to be seen some fruits of two to five leathery follicles covered with soft down. It must be recorded with regret that this beautiful rarity is no longer to be found in other parts of the island.

The *Allium Ampeloposum* was not noticed, probably because it does not blossom before August, and its grass-like leaves can well be overlooked amongst the surrounding herbage. On the side facing the sea were clumps of *Crithmum*, and the white blossoms of the *Cochlearia officinalis*. The plants were all very small compared with those growing on the mainland about Kew-stoke, where the leaves are often a couple of inches in diameter. Amongst them was a variety of *Plantago coronopus* first noticed on the Steep Holm in 1910 by Mr. F. N. Williams, and named at Kew var. *Sabrinæ* after the Severn Sea. The whole plant is much more woolly than the type, and the leaves wider with dentate margins rather than pinnatifid. *Kentranthus*, *Fœniculum*, and *Conium* showed amongst the dominant masses of *Smyrnum* in full bloom. Its large glossy leaves were badly infested with the parasitic *Puccinia Smyrni* as noted by the Cardiff Naturalists nearly forty years before. Mr. Murray saw only the common limestone bramble, *Rubus rusticanus*, which is abundant, but a barren shoot of *R. pyramidalis*, a bramble often to be met with on the mainland, was gathered on this occasion. On rocks leading up to the plateau were small plants of *Polypodium*, *Asplenium Trichomanes*, and *A. Ruta-muraria*; and between the loose stones was *Geranium Robertianum* var. *maritimum* Bab. The gravel paths on the top are moss grown with here and there tiny plants of *Geranium molle* and the rarer *Erodium maritimum*. *Sedum acre* is abundant everywhere, on the rocks and on the ground. A large patch was different in appearance to the others, and in the opinion of Mr. G. Claridge Druce it corresponds with his var. *Drucei*. On the north side of the Island the cliffs rise perpendicularly from the sea, and on the ledges grow *Lavatera arborea*, patches of *Statice maritima*, and *Silene maritima*, the typical plant with purple veins on the sepals, together with the form having bladders of a pale greenish yellow without any markings, common on the Chesil Beach, Dorset. A small quantity of *Limonium binervosum* was noticed with pleasure, because it was seen on Steep Holm in July, 1773, by Sir Joseph Banks and his companion, Lightfoot, and is now lost from many of its positions on the mainland through building operations. Amongst the longer herbage of the downland were small plants of the tiny *Vicia lathyroides*, only previously noted by Mr. Storrie in 1883. It was associated as is often the case with small plants of the more conspicuous *V. angustifolia*. The remaining plants noticed were the same as other observers have recorded.

MOLLUSCA.—BY F. G. PEARCEY, F.R.P.S.E.

In the "Mollusca of Somerset," by Mr. E. W. Swanton, a list of about a dozen species is recorded for the Steep Holm and the Flat Holm; and the Cardiff Naturalists' Society records for 1883 that four species and one variety were seen on the Steep Holm. Since that date no systematic list appears to have been published.

On the present occasion specimens of most of these including three species and one variety of *Hyalinia* and many other kinds were obtained.

The full list of the day's finds is the following:—

LIMACIDÆ.

Agriolimax agrestis L. Not uncommon in damp corners of rock and under stones near the ruins of the hotel and cottage on the summit of the Island.

Hyalinia nitidula Drap. Comparatively rare under stones.

Var. *nitens* Mich. Abundant in sheltered nooks and under stones, especially in damp places and at the roots of nettles.

Var. *cellaria* Müll. Few obtained in company with and in similar localities to *H. nitidula*.

H. crystallina Müll. Very rare; near the ruins of the cottage.

HELICIDÆ.

Helix aspersa Müll. var. *flammea* Picard. Moderately common near the Hotel ruins.

Var. *albo-fasciata* Picard. Common near the old and new habitations and enclosures, and in all suitable places.

Var. *nigrescens* Mog. Comparatively rare in rock crevices.

H. nemoralis L. var. *rubella* Picard. var. *libellula* Risso. At the time of our visit this species was very scarce; several young specimens were taken, which would suggest that it was too early.

As in the case of *H. aspersa* no typical forms were taken; both varieties were found on the summit.

Var. *olivacea* Risso. In ruins of cottage.

Var. *fasciata* Picard. On cottage wall.

Var. *Major* Fér. In similar situation.

H. hispida L. Abundant in suitable localities.

H. virgata De Costo (= *Helicella virgata* De Costa). Rare at the time of our visit on the west side.

H. caperata Mont. (= *Helicella caperata* Mont.). Comparatively rare on the S.E. side.

Helicigona lapicida L. Very rare; on south side.

HAPLOGONA.

Pyramidula rupestris Drap. (= *Helix rupestris* Drap.) Moderately common in rock crevices.

P. rotundata Müll. (= *Helix rotundata* Müll.) Comparatively rare.

PUPIDÆ.

Ena obscurus Müll. (= *Bulimæus obscurus* Müll.)

Pupa secale Drap. A few taken in the rock crevices on the S.W. side.

P. cylindracea De Costa. Common in similar situations.

Vertigo pygmæa Drap. Only two or three specimens obtained, but on further search it may be found more plentiful.

Clausilia bidentata Ström. Common in suitable places.

STENOGYRIDÆ.

Cochlicopa lubrica Müll. Only two specimens obtained, but this species should be more abundant.

Cæcilioides acicula Müll. A few specimens found in the hummocks of grass on rock shelves and crevices.

CYCLOSTOMATIDÆ.

Cyclostoma elegans Müll. Moderately common at the base of the cliffs, in crevices and under stones on the S. and S.W. side.

LAND CRUSTACEA. ISOPODS.

LIGUDÆ.

Ligia Oceanica L. Not common on rocks at low water.

ONISCIDÆ.

Oniscus ascellus L. Abundant everywhere under stones and old timber.

Porcellio scaba Latr. Under stones in cottage enclosure.

ARMADILLIDIÆ.

Armadillidium vulgare Latr. Common under stones at base of cliffs near ruins of Hotel.

ARACHNIDIA (SPIDERS).

LYCOSIDÆ.

Lycosa lugubris Walck. Several found amongst stones and tufts of *Sedum acre*.

DYSDERIDÆ.

Dysdera crythrina Walck. Moderately common under stones.

MYRIAPODA.

JULIDÆ.

Julus niger. Comparatively rare, only two small specimens were taken in old storehouse close to the landing stage.

POLYDESMIDÆ.

Polydesmiis complanatus L. Few specimens taken under stones and decayed wood in a damp corner at the base of the rock face near the Hotel ruins.

LITHOBIIDÆ.

Lithobius forficatus. Moderately common in suitable places.

Two fine specimens of the Blind Worm, *Anguis fragilis* L., were found under a big piece of limestone by a large nest of *Lasius flavus*. The lizards were evidently feeding on the ants' eggs as each one disgorged several on being captured.

In addition, a few crustaceæ, spiders, and myriapods, were met with.

ENTOMOLOGY.—By G. C. GRIFFITHS, F.E.S., AND
CHAS. BARTLETT.

The number of insects taken on 27th May, 1914, was small, just 40 species of all orders being observed. The paucity of insect life may be accounted for by the cold weather which prevailed for some weeks before the visit, and the very bleak and exposed character of the locality. A fortnight later many more species would probably have been recorded. It was a subject of common remark amongst the Entomologists that Diptera were almost unrepresented, and the absence of these so often troublesome pests added greatly to the comfort of collecting.

No rarities were obtained, and the insects met with were in no case numerically abundant, yet it is interesting to note that three species of Hymenoptera, three of Coleoptera, and one of Diptera were not recorded in the list of Insects of Somerset as published in the Victoria County History in 1903. It is reasonable to suppose, therefore, that a longer stay in the Island would considerably enlarge its list of insect inhabitants, and possibly disclose some unexpected facts.

A detailed list of species is appended, with initials of the captors, new records for Somerset being marked with an asterisk.

Coleoptera.

Harpalus tardus (F. G. P. and N. W.)

„ *æneus* „

Amara communis (C. B.)

Brachinus crepitans (F. G. P. and N. W.)

Melanotus rufipes (C. B.)

Ocypus olens (F. G. P. and N. W.)

Ocypus morio „

Lacon murinus „

Meligethes obscurus „

**Syncalyptra hirsuta* (A. E. H.)

Exomias araneiformis (F. G. P. and N. W.)

**Orthochaetes setiger* „

Otiorhynchus sulcatus (C. B.)

**Aleochara fuscipes* „

Hymenoptera.

- Formica fusca* (F. G. P. and N.W.) (C. B.) (A. E. H.)
Lasius flavus „ „ „ „
 * „ *alienus* „ „ „ „
 „ *niger* „ „ (C. B.)
 * *Myrmica scabrinodis* (A. E. H.)
 * *Pemphredon lethiger* (G. C. G.)
Bombus lapidarius (C. B.)

Lepidoptera.

- * *Pieris rapæ* (C. B.) (G. C. G.)
 „ *brassicæ* „
Pyrameis cardui (C. B.)
Lycæna icarus (G. C. G.)
Cœnonympha pamphilus (C. B.)
Euchelia jacobææ (C. B.) (G. C. G.)
Plusia gamma (C. B.)
Euclidia mi „
Zygæna filipendulæ (F. G. P. and N. W.) (C. B.)
Camptogramma bilineata (C. B.) (G. C. G.)
Melanippe galiata (G. C. G.)
Scoparia dubitalis (C. B.) (G. C. G.)
Crambus pratellus (C. B.)
Lipoptycha plumbana (C. B.)

Orthoptera.

- Forficula auricularia* (F. G. P. and N. W.)

Diptera.

- Dilopus febrilis (F. G. P. and N. W.)
Nematobia cylindrica „
*Lonchoëa vaginalis (G. C. G.)

Thysanura.

- Machilus maritima* (F. G. P. and N. W.)

Thanks are due to Mr. Horace Donisthorpe and Mr. F. W. Edwards, and Mr. K. C. Blair, of the British Museum, for the verification of the names of some of the insects; and to Mr. Sleeman, for allowing us the privilege of visiting the Island.

The Water Tubes of *Conocephalum conicum*.

BY AGNES FRY.

AMONG the Liverworts some, *e.g.*, most Ricciaceæ, have the fructification concealed in the thallus: but the far larger number bear it on a stem—of one sort or another. In Mosses, except the *Sphagna*, the seta belongs to the sporophytic generation: in some Liverworts this is also the case, as in the great and preponderating order of Jungermaniales. In this case the seta is often a white, almost translucent thread, consisting of long cells of very rapid growth. By the banks of little streams in late spring one may see the shining stalks of the withering fructification of *Pellia epiphylla*, overborne by their own slight weight, shewing of what a limp texture they have been built. But in the family of Marchantiaceæ it is the oophytic generation which supplies the stem—in one of two ways. In *Marchantia polymorpha*, offshoots of the thallus arise like stalks and carry the archegonia and antheridia aloft. But in *Lunularia* and *Fegatella*, the archegonia are seated under little knobs borne on the thallus, and after fertilization the stalk grows up. Thus fertilization not only creates a new generation but reacts strongly on the old—as in manifold other cases in the vegetable world. It is, however, generally for the sake of *several* sporangia that this effort is made, though in *Lunularia cruciata* I have found a well developed seta bearing a single fertilized archegone. The sporophytic stem, on the other hand, never bears more than a single sporangium. There are other marked differences between the two: the oophytic stems are so far as I have seen of slower growth, firmer texture and greener colour, and have often an epidermal layer of small cells. In several cases they are noteworthy for their strange system of water-tubes.

It is well known that in *Marchantia polymorpha* each arm of the carpopore originates hairs in its tip: these pass down the stalk by one or other of two curiously constructed pipes and so reach the soil. The hairs are hollow and studded internally with little peg-like excrescences.

Less attention has been given, however, to the water system in *Conocephalum conicum*, which will be understood by a reference to Fig. 1.

Not only do hairs pass down the firm stalk which enfolds them near its centre (see Fig. 2) but hairs of the same kind hang down from the arm-pit between the stem and the pendant sporangia: these, however, do not reach the ground, but serve perhaps by their mucilaginous nature to keep the sporangia from drying too quickly. The most noticeable feature of the system, however, does not appear in Fig. 1, but is best explained by a horizontal section taken across *x—y*, where it is seen that the hairs do not pass straight down the tube but first wind round the tops of the stem like a turban.

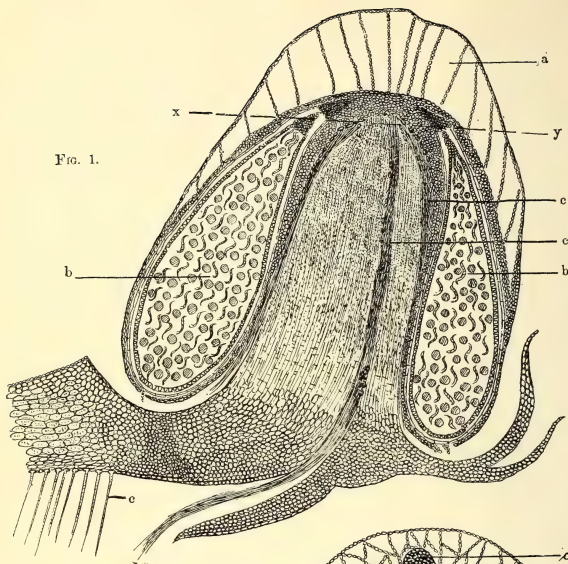


FIG. 1.



FIG. 2.

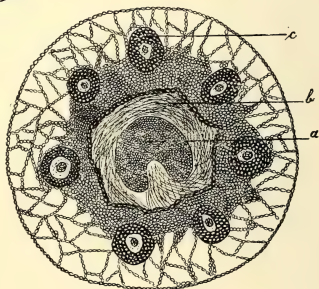


FIG. 3.



FIG. 5.

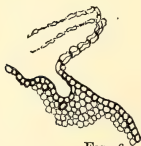


FIG. 6.



FIG. 4.

The hairs arise in large yellow-brown cells which form a cap over the stem. The top of this cap is excentric with the stem, being, as shewn, nearer to the growing end of the frond.

I find no trace of similar hairs in the fructification of *Lunularia cruciata*: but the young carpophore as it emerges is entangled with hairs from the surrounding bracts—these hairs are, however, of a different nature, being chains of cells. Similar hairs are given off from the stem which has no tube running through it. See Fig. 5.

Chains of cells forming hairs are also found on the under side of *Reboulia hemispherica*, but its stalk has a tube and it appears to carry hairs from the cap somewhat as *Marchantia* does. My material is insufficient to work it out thoroughly.

Description of figures illustrating Miss Fry's paper on the Water-tubes of *Conocephalum conicum*:—

Fig. 1.—Longitudinal section through carpophore of *Conocephallum conicum*. A, cap of chlorophyllaceous tissue; B, sporangia with spores and elaters; C, hairs with peg-like intrusions.

Fig. 2.—Stalk of carpophore of C.C. cut transversely halfway up.

Fig. 3.—Transverse section along the line x—y in Fig. 1, of the carpophore of C.C. A, central stem; B, hairs surrounding it; C, stalks of separate sporangia.

Fig. 4.—Young carpophores of *Lunularia cruciata* with hairy covering.

Fig. 5.—Stem of carpophore of *Lunularia cruciata*.

Fig. 6.—Portion of same, more highly magnified.

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MAP SHOWING THE CARBONIFEROUS LIMESTONE OF THE AREA BETWEEN CLIFTON AND CLEVEDON.



Reproduced from the Ordnance Survey Map with the sanction of the
Controller of H.M. Stationery Office.

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Scale : 1 Inch = 1 Mile.

Dips shown thus 30°

Faults thus ———

Coal Measures

D-beds

S-beds

C-beds

Z-beds

K-beds

MAP SHOWING THE BET



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*	Smith, D. Munro, M.R.C.S.	...	...	18 Apsley Road, Clifton
	Smith, H. C.	...	...	13 Acraman's Road, Southville, Bristol
	Smith, W. A., M.B.	...	...	70 Pembroke Road, Clifton

A	Smith, Rev. W. ...	17 Vyvyan Terrace, Clifton
A	Smith, Mrs. W. ...	17 Vyvyan Terrace, Clifton
	Stanton, D. W. ...	42 Alma Road, Clifton
	Stanton, Mrs. ...	42 Alma Road, Clifton
	Stewart, D. McDonald, F.G.S.	25 Woodstock Road, Bristol
†	Strickland, Thompson ...	13 Victoria Square, Clifton
*	Tutcher, J. W. ...	57 Berkeley Road, Bishopston, Bristol
	Underhill, J. ...	2 Brynland Avenue, Bristol
	Walton, J. C. H. ...	18 West Park, Bristol
	Warren, Mrs. Crosby ...	15 Upper Belgrave Road, Bristol
A	Webb, H. Vicars ...	12 Sefton Park Road, Bristol
*	White, Jas. W., F.L.S. ...	18 Woodland Road, Clifton, Bristol
	White, Mrs. ...	18 Woodland Road, Clifton, Bristol
*	Wickes, W. H. ...	16 Oakfield Grove, Clifton
A	Williams, Miss R. L. ...	12 Henleaze Gardens, Bristol
A	Wingate, Miss H. M., M.A. ...	2 Woodfield Road, Redland, Bristol
A	Wood, Miss K. M. ...	Nempnett, Chew Stoke, Bristol
A	Woodey, E. L. ...	47 South Road, Kingswood, Bristol
	Worsley, Miss I. ...	Rodney Lodge, Clifton
	Yabbicom, T. H., M.I.C.E. ...	23 Oakfield Road, Clifton

Honorary Members, 1915 and 1916.

- Prof. George S. Brady, M.D., LL.D., D.Sc., F.R.S., F.L.S., Park Hurst, Endcliffe, Sheffield.
- Henry J. Charbonnier, Haw Lane, Olveston, Tockington R.S.O., Glos.
- G. A. Lebour, Esq., M.A., F.G.S., Professor of Geology in the Armstrong College, Newcastle-on-Tyne.
- R. M. Prideaux, F.E.S., Brasted Chart, nr. Sevenoaks, Kent.
- Prof. Sir Wm. Ramsay, Ph.D., F.R.S. (deceased).
- Prof. H. S. Hele Shaw, M.Inst.C.E., LL.D., F.R.S., 64 Victoria Street, Westminster, S.W. 1.
- Prof. W. J. Sollas, M.A., LL.D., F.R.S., F.R.S.E., F.G.S., University Museum, Oxford
- Prof. S. P. Thompson, D.Sc., B.A., F.R.S., F.R.A.S. (deceased).
- Sir W. A. Tilden, D.Sc., F.R.S., Professor of Chemistry in the Imperial College of Science, S. Kensington, S.W. 7.
- Arthur Vaughan, Esq., B.A., D.Sc., F.G.S. (deceased).
- William Whittaker, Esq., B.A., F.R.S., F.G.S., Freda, Camden Road, Croydon.
- Prof. A. M. Worthington, C.B., M.A., F.R.S., F.R.A.S., Royal Naval Engineering College, Greenwich, S.E. 10.
- Prof. Sydney Young, D.Sc., F.R.S., Trinity College, Dublin.

REPORTS OF COUNCIL

To December 31st, 1915, and 1916.

THE effects of the War have made themselves felt in various ways in the Society, and the attendance at the meetings has not been maintained as in the past, whilst the interesting matters brought forward have not been followed by as much animated discussion as they deserved.

There are now 99 Ordinary and 48 Associate Members, making a total of 147 members. The call for special war work has led to resignations, which, it is hoped, will be withdrawn in less exciting times.

In addition, there are 13 Honorary Members, including Arthur Vaughan, D.Sc., F.G.S., whom the Society had the pleasure this year of electing to that position on his leaving Bristol for Oxford, and in recognition of his valuable Geological work communicated to the Society. (Died the same year).

During the year there were 8 meetings at which members gave papers on attractive natural history subjects, including one by Professor Gamble, F.R.S., of Birmingham University, who visited us specially for the purpose. One of the meetings was devoted to the exhibition of objects possessing local interest, about which short descriptions were given, followed by discussions, and nine members filled up easily a successful evening. The summer excursion to Blaize Castle Woods, Henbury, in July, attracted a number of members and their friends.

Attention was called during the year to the scheme of the Selborne Society for the protection of rare wild flowers in Britain, and Mr. J. W. White was nominated to serve as the local representative on its Committee. At another meeting Mr. White reported on some efforts he had made with the Bristol authorities to prevent unnecessary injury being done to local rarities on our much frequented Downs.

The Council regret to record the loss by death of two esteemed members, Mr. W. B. Waterfall, who was well known for his botanical work during the last 30 years, especially on the study of mosses; and Mr. C. Fortey, a Vice-President and an active geological worker during his long life.

The call of War duties has occupied so many members that the work of the Society has been purposely kept to routine, and with the object of affording occasional change of thought to the lovers of Nature.

Resignations or death have caused the loss of 21 members, and although 14 others have joined, the total now stands at 140, made up of 94 Ordinary and 46 Associate Members. Considering the present circumstances, the support given to the Society has been loyally maintained. In addition, there are 10 Honorary Members, and an arrangement was sanctioned for the admission of students of the Bristol University as members of the Geological section, and to have availed themselves of the privilege.

In a similar way members of our Society were able to benefit by an offer made by the Director of the Bristol Museum, Mr. H. Bolton, F.G.S., of a gift of duplicate specimens of Lepidoptera.

During the year there were 8 meetings at which exhibits were shown and papers were read, particulars of which are recorded elsewhere in the "Proceedings"; and the summer excursion to Oldbury Court Woods, Stapleton, afforded great pleasure to a number of members and their friends.

The Council regrets the loss by death of two Honorary Members, Sir William Ramsay, who was a Past-President; and Professor Silvanus Thompson, who contributed numerous papers when living in Bristol; Mr. H. B. Cornaby, a former Member of Council; and Messrs. G. H. Hiley and F. A. Nuell, active supporters of the Society.

IDA M. ROPER, *Acting Hon. Secretary.*

The HON. TREASURER in Account with the BRISTOL NATURALISTS' SOCIETY.

Dr.	GENERAL ACCOUNT FOR THE YEARS 1915 AND 1916.				Cr.	
	1915.	1915.	1915.	1915.	1916.	1916.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
To Members' Subscriptions—						
Ordinary ...	32 10 0	20 10 0				
Associate ...	8 0 0	6 5 0				
Entrance Fees ...	0 15 0	0 5 0				
Subscriptions in advance ...	1 10 0	1 0 0				
Arrears collected ...	16 15 0	3 10 0				
Sale of Proceedings ...	0 3 6	0 2 0				
Profit on Excursions ...	0 4 6	0 9 0				
Balance forward ...	13 8 9	50 7 1				
Balance due to Hon. Treasurer	—	1 12 0				
	£73 6 9	£84 0 1				
By Subscriptions to Societies—						
Ray ...				1 1 0	1 1 0	
Commons and Footpaths ...				0 10 6	0 10 6	
Zoological ...				1 10 0	—	
Printing Proceedings of 1914 ...				—	15 16 0	
Printing ...				1 17 6	1 18 0	
Books bought ...				1 3 8	—	
Fire Insurance ...				0 7 6	0 7 6	
Rent of Library and Rooms ...				6 6 0	9 4 6	
Postages, &c. ...				5 9 9	4 19 2	
Gratuities... ..				2 10 6	2 0 0	
Balance due to Hon. Treasurer				2 3 3	—	
Cash in hand and Bank ...				50 7 1	48 3 5	
	£73 6 9	£84 0 1		£73 6 9	£84 0 1	

Audited and found correct,

ERNEST H. COOK,
CHARLES BARTLETT, A.C.A. } *Auditors.*

December, 1916.

LIBRARIANS' REPORTS

For the Years 1915 and 1916.

DURING 1915 books have been borrowed by 13 members, which is less than 9 per cent. of the membership. The number of volumes borrowed was 62. Of these, 7 were still out at the end of the year; as were also 1 borrowed in 1914, 3 in 1913, and no less than 10 taken out by one member in 1912. We think it will be necessary for the Council to legislate on this point, for it is not right that certain books should be monopolised by individuals for long periods, thus preventing other members consulting them.

No volumes have been bound during the year.

We have received from Corresponding Societies 5 bound volumes and 341 unbound parts of current publications. Thanks are due to the following donors of books, &c. :—

Dr. SYDNEY YOUNG, F.R.S., for "*Philosophical Transactions of the Royal Society*," Series B, Vol. 205 (1915).

Dr. A. B. PROWSE, for 6th and 7th Reports of the Botanical Committee of the Devonshire Association (1914-15).

ENTOMOLOGICAL SECTION, B.N.S., for "*Entomologist*," 35 Parts.

GEOLOGICAL SECTION, B.N.S., for "*Geological Magazine*," 14 Parts.

PALÆONTOGRAPHICAL SOCIETY, Vols. 66-68 (1912-14).

We have received subscription volumes from :—

RAY SOCIETY, one volume ; "*Zoological Record*," Vol. 50 (1913); Taylor : "*British Mollusca*," Part 21; Morley : "*British Ichneumons*," Vol. 5.

The Exchange list is rather shorter than in 1914.

During 1916 only 15 members have borrowed books, and the volumes taken out number 93. Of these 7 were still out at the end of the year; and of those borrowed in 1915, 1913, and 1912 there were respectively 3, 3, and 10 not then returned to the Library.

No books have been bound during the twelve months.

We have received from the Corresponding Societies 3 bound volumes and 392 unbound parts of current publications.

To the following donors of books and pamphlets we tender our sincere thanks :—Dr. SYDNEY YOUNG, F.R.S., for "*Philosophical Transactions of the Royal Society*," Series B, Vol. 207 (1916); Dr. LLOYD MORGAN, F.R.S., for "*Quarterly Journal of the Geological Society*," 19 Parts of various years; ENTOMOLOGICAL SECTION, B.N.S., for "*Entomologist*," parts of 1915 ; "*Entomologists' Monthly*," 1915 ; GEOLOGICAL SECTION, B.N.S., for "*Geological Magazine*," 2 Parts, 1916.

The following subscription volumes and parts have been received :—"*Zoological Record*," Vol. 51 (1914); Taylor : "*British Mollusca*," Vol. 4, Part 1.

We have, of course, received no exchanges from Germany and Austria. With these exceptions, the EXCHANGE LIST remains as it was.

ARTHUR B. PROWSE, Lieut.-Col., R.A.M.C., *Hon. Librarian.*

IDA M. ROPER, F.L.S., *Hon. Sub-Librarian.*

EXCHANGE LIST.

Ashmolean Natural History Society of Oxfordshire
 Barrow Naturalists' Field Club
 Belfast Naturalists' Field Club
 Birmingham Natural History and Philosophical Society
 Bristol Museum and Art Gallery
 British Association
 British Museum (Natural History), S.W.
 Cardiff Naturalists' Society
 Chester Natural Science Society
 Clifton College Scientific Society
 Cornwall, Royal Geological Society of
 ———, Royal Institution of
 ———, Royal Polytechnic Society
 Cotteswold Naturalists' Field Club
 Ealing Scientific and Microscopical Society
 Edinburgh Geological Society
 ——— Royal Botanic Society
 Essex Field Club
 Geological Society of London
 ——— Survey and Museum, London
 Geologists' Association
 Glasgow, Geological Society of
 ———, Natural History Society of
 ——— Philosophical Society
 Hertfordshire Natural History Society and Field Club.
 Liverpool Geological Society
 ——— Literary and Philosophical Society
 ——— Science Students' Association
 Manchester Literary and Philosophical Society
 ——— Microscopical Society
 ——— Museum Library
 Marlborough College Natural History Society
 North Staffordshire Field Club
 Norfolk and Norwich Naturalists' Society
 Nottingham Naturalists' Society
 Plymouth, Marine Biological Association of the United Kingdom
 ——— Institution, and Devon and Cornwall Natural History Society
 Quekett Microscopical Club
 Royal Irish Academy
 Royal Microscopical Society
 Rugby School Natural History Society
 Torquay Natural History Society
 Woolhope Natural History Field Club
 Yorkshire Geological and Polytechnic Society
 ——— Naturalists' Union
 ——— Philosophical Society

Our "Proceedings" are sent as a free gift to :—

British Museum Library Cambridge University Library Dublin, Trinity College Library		Edinburgh, Advocates' Library Oxford, Bodleian Library Patent Office Library, London
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AUSTRALIA.

Australasian Association for the Advancement of Science
 New South Wales, Geological Survey
 ———, Royal Society of
 Queensland Museum, Brisbane
 Victoria, Royal Society of

CANADA.

Canadian Institute, Toronto
 Hamilton Scientific Association
 Nova Scotian Institute of Natural Science (Halifax)

INDIA.

Agricultural Journal of India
 Agriculture, Imperial Department of
 Geological Survey of India, Calcutta

FRANCE.

Lyon, Société Linnéenne de
 Rennes, University of

NORWAY.

Det Kongelige Norsk Universitet Christiania

SWITZERLAND.

Lausanne, Société Vaudois des Sciences Naturelles
 Zürich, Naturforschende Gesellschaft

UNITED STATES.

American Museum of Natural History, New York
 Augustana College, Rock Island, Illinois
 Boston, Mass. Natural History Society
 Brooklyn Institute of Arts and Sciences, Coldspring Harbour
 California, University of, Berkeley
 Californian Academy of Sciences, San Francisco
 Cincinnati Natural History Society
 ———, Lloyd Library
 Colorado College, Colorado Springs
 ———, University of, Boulder
 Denison Scientific Association, Ohio
 Elisha Mitchell Scientific Society, Chapel Hill, N.C.
 Essex Institute, Salem, Mass.
 Illinois, University of, Urbana
 Indiana Academy of Science
 Michigan Academy of Science
 Missouri Botanical Gardens
 ——— Academy of Science, St. Louis
 New Mexico, University of, Albuquerque
 Ohio State University, Columbus
 Oklahoma State University
 Philadelphia Academy of Natural Sciences
 ———, Wagner Free Institute of Science
 Smithsonian Institution, Washington
 Tufts' College, Mass.
 United States Geological Survey, Washington.
 ——— National Museum, Washington
 Yale University, Connecticut.

ARGENTINE REPUBLIC.

Buenos Aires, Muses National de Historia Natural

URUGUAY.

Montevideo, Museo Nacional de

MEXICO.

Mexico, Sociedad Científica

GEOLOGICAL SECTION

1915 and 1916.

I HAVE again to regret the falling of membership and to record the death of one of our most prominent members, Dr. Arthur Vaughan, who had been a member of the Section for many years, whose loss will be greatly felt by the Society. When resident in Bristol he contributed many papers, and his classical work on the zoning of the Mountain Limestone, which was published by the Society, has become a world-wide reference on those rocks.

At the annual meeting Professor S. H. Reynolds, M.A., F.G.S., was re-elected President, and B. A. Baker, F.G.S., Hon. Secretary and Treasurer.

There have been seven meetings, when the following Papers were read :—

- January 15.—“Notes on the Geology of Australia”
Prof. S. H. Reynolds, M.A., F.G.S.
February 18.—“Peat”
C. Hunter
March 27.—“Prehistoric Man”
C. J. Gardiner, F.G.S.
April 29.—Exhibition Meeting.
October 21.—“The Age of the Earth”
Prof. S. H. Reynolds, M.A., F.G.S.
November 18.—“Fossil Plants”
Miss E. M. Lee, M.Sc.
December 16.—“Lower Lias and Rhætic around Bristol”
J. W. Tutchter

All the papers were illustrated by lantern slides and most of them by specimens in connection with the subject.

Some meetings were well attended, the numbers present being from 12 to 25, but the falling off in attendance and membership is no doubt owing to the war, as many are giving help in some form or another.

The Financial Report shows receipts £4 5s. 6d. and expenses £4 os. 11d., which, with a balance forward, leaves 18s. 4d. in hand.

There were 48 members at the end of 1916, the greater number being student members.

At the Annual Meeting Prof. S. H. Reynolds, M.A., F.G.S., was re-elected President, and B. A. Baker, F.G.S., Hon. Secretary and Treasurer.

The following papers were read :—

- January 27.—“Maps”
The President
February 17.—“The Soils in Relation to Agriculture”
Miss L. Batten
March 16.—“The Life of Prof. Adam Sedgwick”
Miss E. Bolton, B.Sc.
April 13.—“Gloucestershire, its Scenery and Industries
(illustrated by lantern slides)”
L. Richardson, F.G.S.
May 18.—“Map-making in Canada”
W. H. Davies
(Illustrated by Maps and Diagrams).
October 19.—“National Progress in Geology”
The President
November 16.—“Deserts”
Miss D. E. Sage
December 19.—Visit to the Museum to inspect the raised model and
contour map of the Bristol District.

There was an average attendance of 18 members.

The Financial Report shows receipts during the year of £5 10s., with an expenditure of £5 1s. 9d., and, with the balance brought forward, there is £1 6s. 7d. in hand.

B. A. BAKER, *Hon. Secretary and Treasurer.*

ENTOMOLOGICAL SECTION

1915 and 1916.

TWO MEETINGS only were held during the year 1915, but as a result of a considerable accession of new members in 1916, eight meetings were held. The Section now consists of 17 members. There were no papers but many rare and interesting exhibits and notes were made, of which the following were the most important.

January 26th, 1915—Mr. G. C. Griffiths, box of butterflies taken by Major Broughton in the Himalayas. Mr. C. Bartlett, six drawers of British Coleoptera.

May 4th—Mr. G. C. Griffiths, *Sesia andreniformis*. Mr. H. Bolton sent a beetle of the Genus *Ceratorrhina* from W. Australia, there being only 1 ♀ and 3 ♂ otherwise known. Mr. C. Bartlett, *Celerio galii* bred from larvæ, N. Cornwall, hybrid *Biston hirtaria* x *zonaria*.

January 11th, 1916—Mr. G. C. Griffiths, box of Catocalidæ.

February 17th—Miss Roper, the fungus *Cordiceps militaris*, parasitic on the pupa of a moth, Blackdown. February 2nd, 1916—Mr. A. E. Hudd, Diptera taken in January and February. Mr. G. B. Hony, box of Coleoptera from the Outer Hebrides. Mr. G. C. Griffiths, *Lælia cænosa*.

March 17th—Miss Roper, Galls caused by *Diastrophus rubi* on *Rubus rusticanus* and *cæsius*. Mr. H. J. Charbonnier lectured on British Diptera, illustrated by hand-coloured charts and specimens, and gave many very interesting notes on classification, collecting, habits, &c.

April 14th—Miss Roper, the fungus *Cordiceps entomorrhiza*, parasitic on the larva of *Hepialus humuli*. Mr. C. T. Gimmingham, 71 species of Somerset Coleoptera. Mr. G. C. Griffiths, a living ♀ of *Nyssia zonaria*.

May 16th—Miss Roper, Beetles. Mr. H. A. Francis, nest of *Eumenes coarctator*.

October 20th—Miss Roper, Beetles. Dr. C. K. Rudge, Oak galls. Mr. G. C. Griffiths, *Argynnis paphia* var. *confluens*. Mr. A. E. Hudd, Notes on "Scarabs, ancient and modern," with Egyptian examples.

November 24th—Miss Roper, preserved larvæ of British lepidoptera. Mr. G. C. Griffiths, specimens of the Genera *Kallima* and *Parnassius*. Mr. C. Bartlett, box of British Coleoptera, including *Anomala frischii* unicolorous blue green var.

December 8th—Miss Roper, stem of yarrow with galls of *Rhopalomyia millefolii*. Mrs. Sandwith, *Lucanus cervus* ♂. Mr. G. C. Griffiths, *Lophostethus Demolinii*. Mr. H. L. Audcent, box of flies from Dunster, including *Anthrax hottentola*, *Catabomba pyrastris* and *Volucella inanis*.

LIST OF MEMBERS.

G. C. GRIFFITHS, President.

A. T. DAVIES.	J. F. KNOWLSON.
H. A. FRANCIS.	P. J. MOUNTNEY.
C. T. GIMMINGHAM.	J. NORTHMORE.
G. B. HONY.	Miss ROPER.
A. E. HUDD.	Dr. C. K. RUDGE.
W. B. IVENS.	Mrs. SANDWITH.
Col. T. JERMYN.	Dr. W. A. SMITH.

CHARLES BARTLETT, Hon. Sec.

Account of the General and Annual Meetings.

The following accounts have been compiled by the Acting-Secretary, but the Reports are due to the Reporting Secretary, Mr. J. T. Kemp, M.A., whose summary appeared in the local Press after each meeting.

THE 52ND ANNUAL MEETING.

January 21st, 1915.

The Council and Officers for the year were elected, Miss Ida M. Roper being the President for the third time, and Dr. O. V. Darbishire the Hon. Secretary.

Exhibits were shown by Mrs. H. E. Matthews, *Geaster fimbriatus*; Miss Roper, *Viola odorata* var. *præcox*; Mr. A. T. Davies, nodules on *Thuja*.

Miss Roper then delivered her second Presidential address entitled "The Permanency in the Growth of Plants."

(N.B.—The address is printed in full in the Proceedings for 1914).

THE 446TH GENERAL MEETING.

February 4th, 1915.

"Mr. Eliot Howard's Observations on British Warblers,"

by Prof. C. Lloyd Morgan, LL.D., F.R.S., F.G.S.

These observations, published in book form, were the outcome of the hobby of a man of commerce, and threw a new light on the habits of these migrants. He describes how the males arrive first, some fortnight before the females, and establishes a territory free from rivals, but not the same each year. This effected, amidst much singing and fighting, there is a period of courtship on the arrival of the females, filled in by flapping of wings, fighting other males but with less singing, the whole seeming to be watched only a little by the females. It appears that similar movements are made by the different birds, varying according to its species, on any occasion of great excitement, as in fighting or courting, or in anger or fear, due to inherited instincts from natural selection. Such activities, however, are, it is admitted, difficult to account for, though they appear to be as distinctive as are form and colour and habits of nest building. The warblers have their own characteristic song, but constantly introduce into it imitations of many other birds without any apparent purpose.

Many lantern slides were shown to illustrate appearance and habits.

THE 447TH GENERAL MEETING.

March 4th, 1915.

"Impressions of Java," by Prof. S. H. Reynolds, F.G.S.

The Island of Java, which belongs to the Dutch, and is densely inhabited, has on its surface many evidences of highly volcanic origin. It was under the Buddhists from India of the 6th and 7th centuries that the numerous magnificent temples and other buildings arose, to be added to in a less grandiose style by the Brahmins of the 15th century, both sets being entirely neglected by the Portuguese traders, who took possession of the island from 1620 to the time of the Napoleonic wars. The British, however, were rulers for a few years, and Governor Raffles unearthed and described these buildings, the grandeur of the carvings in which could be judged from the lantern slides shown.

The inhabitants, as seen by the lecturer on his two visits, are of a mixed race, having much Dutch blood, and live in huts amongst groves of trees, with few towns, and cultivate their tropical regions with much success, being quiet and amiable under their native regents. Addicted to gambling, cock-fighting, and long theatrical dramas of Hindu origin, they have of late sought for education with much freedom of equality for both sexes.

Exhibit by Mr. G. C. Griffiths, F.E.S., of Butterflies from Darjeeling, N.-W. India, sent home by Major T. D. Broughton, R.E., a former member of the Society.

THE 448TH GENERAL MEETING.

April 8th, 1915.

"The South Wales Tornado," by Dr. E. H. Cook, D.Sc.

In October, 1913, a tornado of extraordinary violence arose at Exmouth, South Devon, and travelled in a north-westerly direction for about 200 miles to Widnes in Lancashire, crossing the Bristol Channel from about Watchet to Barry and passing up the Welsh hills by way of Shrewsbury to its ending.

It was amidst the hills of Wales that it was most violent, and there in its very narrow track it effected much damage to buildings and trees with some curious freaks brought about by the sudden withdrawal of air pressure behind its gyrations. These caused windows to be blown outwards, and trees to be sucked under a house roof together with a tablecloth from a lower room. There was fortunately little loss of life or injury to anyone.

Exhibits by Dr. C. K. Rudge of a live beetle, *Carabus monilis*, captured by his soldier son when trench-digging in France; by Mrs. Sandwith, of some caddis worms; by Mr. C. Bucknall, of abnormal catkins of *Salix caprea* in which the anthers had developed into ovaries.

THE 449TH GENERAL MEETING.

May 6th, 1915.

“Living Plant Material,” by Dr. O. V. Darbishire, Ph.D.

Plants were of interest to the ancients chiefly for their medicinal properties, especially their roots, and even after the advent of the new learning on to the time of Linneus that remained responsible for their study by the botanist. The scientific comparison of new species changed the point of view, and the perfecting of the microscope about 1820 caused the structure of living plants to be examined and then their association in communities. With many interesting details about this progress Dr. Darbishire showed how in modern inquiry the mode of living had become of most import, which led to the need for botanic gardens, where the plants could be studied in groups under most natural conditions. Examples were given of such places in Britain, and with living specimens and apparatus on the table the functions of different parts of plants were illustrated.

ANNUAL EXCURSION.

July 17th, 1915.

This was made to Blaize Castle Woods, Henbury, which, through the kindness of Mrs. Harford, were viewed in bright sunshine by the thirty-five members present. Afterwards a visit to the Henbury Vicarage Garden, with its rock flowers, was enjoyed.

THE 450TH GENERAL MEETING.

October 7th, 1915.

Exhibits of Natural History by the Members.

The President, Miss I. M. Roper, F.L.S., nine examples of scarce alien plants, with an account of their probable place of origin and method of introduction by seeds. They were: *Plantago arenaria*, *Vicia varia*, *Orobanche ramosa*, *Abutilon avicennæ*, *Chrysanthemum coronarium*, *Xanthium spinosum*, *Alyssum incanum*, *Ambrosia artemisiifolia*, and *Cerinthe minor*.

Mr. G. C. Griffiths, F.E.S., some Lepidoptera, local and from Surrey.

Mr. W. H. Wickes, geological specimens of Cotham marble, polished gypsum, &c., about which he told interesting facts.

Mr. J. W. White, F.L.S., yellow fruited *Rubus rusticanus*, and *Centunculus minimus*, a recent addition to the local Flora.

Mr. Chas. Bartlett, collection of implements, dress, &c., from British New Guinea, including human skulls secured from a cannibal feast.

Prof. S. H. Reynolds, F.G.S., model of the oldest bird known, the fossil *Archæopteryx*; photographs of the eruption of Vesuvius, and a collection of gems from Ceylon.

Mrs. Sandwith, larvæ of *Vanesso Io*.

Dr. O. V. Darbishire, Ph.D., living specimens from the University Experimental Hothouse of Euphorbia, Cacti, and other succulent plants illustrative of the amount of water stored in the tissues.

Mr. J. T. Kemp, example of fasciation.

THE 451ST GENERAL MEETING.

November 4th, 1915.

"Mount Vesuvius," by Prof. S. H. Reynolds, F.G.S.

The history of this volcano was sketched from Roman times, and made doubly interesting by the fine series of lantern slides of scenery in the neighbourhood and of eruptions, with many details of its geology and what it revealed.

Exhibits by Dr. O. V. Darbishire of dust from the last eruption of Vesuvius; by Miss Prowse of leaves of the Canterbury bell showing the fibrous skeleton; and of a jasmine plant with roots at parts of the stem in contact with a wall; by Mrs. Knowlson of various shaped fruits of the gourd; by Mrs. Sandwith of a reed warbler's nest; by Miss Worsley of the Squinting Cucumber in flower and fruit; by Miss Roper of *Mercurialis annua* var. *ambigua*.

THE 452ND GENERAL MEETING.

December 2nd, 1915.

"Symbiosis—the Co-operative Principle in Biology," by Prof. Gamble, F.R.S., of Birmingham University.

Evolution of species in the Natural world may be influenced by the living together of organism for mutual help as much as by antagonism. This occurs in different branches, as illustrated in the case of plants by the mycelial growth at the roots of poplar and beech trees, of orchids, heath, and gentians for obtaining a greater water supply, and giving nutriment in return, by the formation for nodules of animalculæ on the roots of the pea family, and by the formation for the lichens from the symbiosis of algae and fungus.

Turning to the animal kingdom, similar advantages result from the combination. The species of *amœba* with an internal alga to absorb the waste nitrogenous matter gave in return a supply of extra oxygen, and so both organisms prospered ahead of their competitors. The sea anemones and corals derive the benefit of bright colouration from algæ growing within the flesh exposed to light, and in like manner the green fly and certain scale insects have a companion to share their living state.

Exhibits by Mrs. Sandwith of *Leucadendron argenteum* from Table Mountain; and by Mrs. H. E. Matthews of *Scilla autumnalis* from St. Vincent's Rocks.

Owing to the sudden death of Prof. Barrell, of the University, in the morning the meeting was held in the Museum Lecture Theatre by kind permission of the Director, Mr. H. Bolton.

THE 53RD ANNUAL MEETING.

January 20th, 1916.

Mr. G. C. Griffiths, F.E.S., was elected President for the year, with minor alterations in the Council and Officers.

Exhibit by Mrs. Sandwith, a living cocoon of the Emperor moth.

After a vote of thanks, accompanied by a bouquet of flowers, to the retiring President, who had held the office for three years, Miss Ida M. Roper delivered her Presidential address, entitled "Mistletoe." (Printed in full in the present Proceedings.)

THE 453RD GENERAL MEETING.

February 3rd, 1916.

"The House-fly and Disease," by Dr. W. A. Smith, M.B.

This subject has of late attracted much attention as the public has begun to realize how dangerous the common fly is to human beings and especially to children. The methods by which it transfers disease germs are numerous, and its life-history and habits, with its freedom in visiting everywhere make it necessary for constant efforts to be made against its too rapid increase. The spread of typhoid fever and infantile diarrhoea when summer heat prevails can be clearly traced to the plague of flies, and various preventive measures can be easily applied by the public with a little care. Many points to bring home the need were illustrated by lantern slides.

Exhibits by Miss I. M. Roper, F.L.S., of the fungus *Cordiceps militaris* on the pupa of a moth; by Dr. C. K. Rudge of an Hemipterous insect from Java mimicking a moth living there; and by the President of the Emperor moth in its two stages of growth.

THE 454TH GENERAL MEETING.

March 2nd, 1916.

"Food Values and Food Economy," by Mr. C. T. Gimingham.

Under the war conditions it has become necessary for every one to reduce the amount of food consumed, and a knowledge of how much is required to sustain efficient powers of work enables a proper proportion to be prepared for everyday use. To this end a dietary to show the fats, the hydrocarbons, and the protein in each article of food is important, as well as to know what to avoid in quantity, and many suggestions to bring about this were mentioned and the reasons for their effectiveness described.

Exhibits by Mrs. Sandwith of Tadpoles in various stages; and by Mr. L. H. Matthews of a living fifteen-spined stickleback, *Gasterosteus spinachia*.

THE 455TH GENERAL MEETING.

April 6th, 1916.

"The Natural History of Brean Down, Somerset."

The facts concerning this interesting headland were described by three members, who had each studied a special portion of it.

Prof. S. H. Reynolds, F.G.S., dealt with the geology, and showed it was the worn-down remnant of a much higher ridge of hills.

Mr. H. Vicars Webb told about the formation of the Bird Sanctuary, and how it was already becoming the haunt of rare birds, some of whose habits afforded an interesting study.

Mr. J. W. White, F.L.S., enlarged on the details given in his "Flora of Bristol" concerning the plants specially associated with that isolated and wind blown island.

Exhibit by Miss I. M. Roper, F.L.S., of the rare apricot-coloured violet *Viola odorata* var. *sulphurea*.

THE 456TH GENERAL MEETING.

May 4th, 1916.

"Some Personal Observations of Owls and Kestrels," by

Mr. H. Vicars Webb.

There is an idea that these kind of birds are destructive to game and poultry, but a study of their food supply shows them to be very advantageous to keep down vermin. The characteristic manner in which the birds poise and descend violently on their prey is made possible by the natural power of eyes and talons, and fortunately their habits of intense watchfulness result in their keeping plentiful for their ways to be studied by those who seek them or know how to attract them by an imitation call-note.

Dr. G. Munro Smith also read some notes by his son, now on war service, on the little Owl recently introduced into England, where it is increasing rapidly, and affords much interest by its daylight hunting.

Exhibit by Miss Ida M. Roper of a hybrid of the primrose and the cowslip, sometimes mistaken for the species oxlip.

ANNUAL EXCURSION.

June 24th, 1916.

The summer excursion was made to Oldbury Court Woods, near Bristol, by kind permission of Mr. H. Vassall, and its varied attractions of plant life were enjoyed by the numerous company. Mr. H. Vicars Webb described some of the birds, with details of the life habits of others, especially of the cuckoo, wryneck, and corncrake.

THE 457TH GENERAL MEETING.

October 5th, 1917.

Exhibits of Natural History by the Members.

The President, Mr. G. C. Griffiths, F.E.S., a collection of butterflies and moths, including the genus *Psyche* that pupates on St. Vincent's Rocks in numbers; shells from Highcliffe clay, near Boscombe, Dorset.

Miss Ida M. Roper, F.L.S., the orchid *Helleborus atro-viridis* and the hybrid *Erigeron Hülsenii*, which has an annual composite for one of its parents; both rare plants in England and new discoveries for this district.

Mrs. Sandwith, dragon-flies, the Privet Hawk-moth, and living specimens of *Chara* and *Utricularia*.

Mr. J. F. Knowlson, the nest of the Leaf-cutting Bee.

Mr. J. W. White, F.L.S., three alien species of *Panicum*, found growing on refuse heaps in Bristol.

Mr. L. H. Matthews, the bat *Vesperugo pipistrellus*, captured on the Mendips.

Dr. O. V. Darbishire, the fungus *Fomes igniarius*, from near Bath.

Mr. J. T. Kemp, M.A., told of the final destruction after its death of the oak tree at Shellard's Lane Farm, Alveston, Glos., mentioned by Knapp: "Journal of a Naturalist," 1829.

THE 458TH GENERAL MEETING.

"British White Butterflies and their Foreign Allies," by

Mr. G. C. Griffiths, F.E.S. (President).

The Pieridæ or white butterflies have but few species in Britain, but they are representative of the divisions of the sub-family and very plentiful everywhere. There is, however, one species, *Aporia crataegi*, which has completely disappeared since 1868, and fresh introduction of it from the Continent has not been effective, although another species *Pieris brassicæ* is yearly recruited by large migrations thence. The small white *P. rapæ* is the most common, and this species has largely driven out the native species *P. protodice*, in America, where it has increased so as to become a pest, needing to be checked by a parasite from England. The pupa of this species varies for protective colouration with the object on which it fastens. The other species of the family are strongly migrant, which causes much variation in their numbers year by year in Britain, and it is similar with their exotic allies.

Exhibits by Miss Fryer of fresh flowers of *Ornithogalum latifolium* from the Cape, and dried specimens of *Boronia* from

Ballarat; by Mrs. Sandwith of the pupa of the dragon-fly and *Damasonium stellatum* from Hants; by Mr. T. Morgans of a composite plant raised from seed sent by his son from Gallipoli; by Mr. H. J. S. Gibbons of a living Black rat *Mus rattus*, captured in a Bristol warehouse; and by Miss Roper of a late flowering *Rosa canina*.

THE 459TH GENERAL MEETING.

December 7th, 1916.

“Spiders,” by Rev. H. Arnold Cook, M.A.

Spiders possess many specialised parts, including their breathing apparatus, which resembles modified fish gills, and their powerful jaws, with poison glands at the base, to paralyse their prey. The formation of the feet for moving rapidly on the lines of the web and the brilliant eyes, with other adaptations of the various species, were described by the help of diagrams and living specimens.

Exhibits by Miss Ida M. Roper, F.L.S., of a large cockroach from Central Mexico, brought with bananas; and by Mr. H. J. S. Gibbons of exotic spiders from the same source.

After discussion it was decided that the present officers of the Society should continue in office, with Miss E. M. Lee, M.Sc., acting as Assistant Hon. Secretary, and that the holding of meetings in 1917 on account of the war should be left open.

PRESIDENTIAL ADDRESS

BY MISS IDA M. ROPER, F.L.S.

“MISTLETOE.”

I THANK you most heartily for the cordial vote of thanks you have passed at the close of my term of office. The Society has never had a Lady President in its history, and from your applause I think I may conclude that the experiment in your opinion has met with some success. I am glad to have shown that the study of Natural History, in one branch at least, can be successfully mastered by women folk in the same way that they have proved their ability to serve the community in other spheres of usefulness during the present war.

My inexperience in some matters might have led to mistakes, but I have received such constant assistance from all the members to make my path smooth that the three years Presidency has been a source of much pleasure to me, and I shall always remember the kindly words that have been expressed to-night about my efforts.

During the past year there has been no inclination to give close attention to scientific pursuits, as the claims on the energies of the members have been needed in many other directions. As a result the Society has confined itself to the usual monthly meetings and a walk through the Blaise Castle woods in the summer. It was better under the circumstances for individual members to carry out field work on their own in any spare time at their disposal, and I hope that they will give the Society the benefit of their researches at future meetings.

It is fitting that mention should be made of the loss sustained by Natural History during the year by the death of the great French field naturalist, Henri Fabre, who devoted his long life to making observations on the habits of all kinds of insects and describing their marvels in language that was clear to his readers and yet full of poetic ideas.

In our own Society we have also to record the regretted death of William Booth Waterfall, Fellow of the Linnean Society, and one of our earliest members, who had gained a wide reputation for his knowledge of mosses, and for his ever-ready willingness to give help to those who applied to him on that difficult subject. Within the last month also Arthur Vaughan, Doctor of Science and Fellow of the Geological Society, has passed away at an early age. The geological section of our Society received great encouragement from his researches and work on the Avon Gorge, and although he ceased his connection with Bristol and removed to Oxford, the Society felt it was honouring him as well as itself by electing him a year ago to join the ranks of its honorary members.

On looking back over the past three years it may have been noticed that the subject of Botany has been to the fore, in the exhibits at the meetings and at the annual Exhibition nights. This is not to be wondered at, because the members would expect that the subject best known to their President would be specially spoken about and explained.

Another reason for it may be that for several years past a most active search has been going on locally for botanical treasures, in order to bring about a more complete knowledge of the plants of the country marked out by the natural limits of the Bristol coalfield.

Those members whose interests are taken up with the hobby of field botany know that a good harvest has rewarded their work by the addition of many new plants to the previously long lists, and they have learnt that more information can be gained each year and a healthy life be fostered by this harmless pursuit. Many others could share in these pleasures, for they lie within a few miles of their homes, or at a greater but still moderate distance, and there is no need for a long and systematic study of Physiology in order to stimulate an interest in the floral treasures of our fields and hedgerows. It needs but a small effort to seek out the commoner flowers and to learn something of their habits and life history. From a little such knowledge more will follow, and a growing delight awaits him who plunges deeper into the mysteries of plant life.

The present age has been described as one of locomotion, and amongst those who could couple Nature study with their motor or cycle travels, the desire for long distances has undoubtedly taken away their interest in the lowly beauties that they rush past without a care.

It need not be thought that simple observations on flowers lead to no results. If local investigations are concentrated on ordinary details, and students of Nature try to gather up the visible habits that make up the living history of some well-known plant, constantly met with in their rambles, they might help, in proportion to their industry, the search after honest and straightforward facts.

As a small illustration of what can be done in our own neighbourhood even during the hard winter months, when all Nature seems to hide herself from observation, I would instance what I have been able to learn recently concerning the well-known Mistletoe. This is a shrub so curious in form and with habits so at variance with the idea held by the ordinary person as to how plants should behave, that it compels attention. Added to this, it can be sought out and studied when trees are leafless and barren-looking, and is seen at its best at a time of year when other out-of-door studies in plant life are less pressing and less available.

There are occasions, it may be admitted, when observation should be devoted to flowers that have several nearly related species, because they can be watched and compared in their different forms and habits ; on the other hand much can be made out of a solitary species, and that is how the mistletoe fits well into such a scheme. The mistletoe has no close relation in Britain, and the botanist has been compelled to set it in an order by itself.

It is a plant of the southern and midland counties, whilst further north it is rare, and is not found as a native in Scotland and Ireland. With a shrub frequently to be seen around Bristol what is more natural than to keep a look out for it and watch its habits? and to the steady observer it can yield many facts of an interesting character.

At the beginning of the search one detects it in almost every orchard, pendent from the mossy branch of some old apple tree ; and the Mistletoe and an apple tree become associated in one's mind. Then a large bunch is noticed high up on a lofty tree, with no leaves of its own in winter time to hide the bright green mass, and it is evident that the common Italian black poplar shares with the apple this distinguishing mark. Or, again, when passing along one of the main roads out of Bristol it can be detected hanging from the rugged bark of the white flowering acacia, or sprouting upwards on the spreading branches of many lime trees. Thus as one wanders out and home again on winter rides the mind half unconsciously keeps a look out for the mistletoe. In this way the feeling becomes a sporting instinct, and all the delights of a harmless chase serve to brighten the miles, and a new clump of mistletoe, even if seen on a kind of tree already known to bear it, makes the ride a successful winter's outing.

In such a manner I have sought for the plant during the last year, and know now from actual observation upon what trees it certainly likes to develop its juice-sucking habit, and what ones appear to be able to keep off this enemy, out of the many that attack our native trees.

For it must be known to all of you as common knowledge that the mistletoe is a parasite—that is, it obtains much of its regular supply of food from the juices of other and nobler plants. The word parasite was applied in olden times to a person who introduced himself at the table of the rich in order to obtain a free meal, so in modern language it has become an appropriate word to describe the plant that makes a home for itself in the substance of some other plant and lives on food sucked from its tissues.

Nature provides examples of many kinds of a similar parasitic habit, both in the animal and vegetable kingdoms, each kind usually confining itself to a limited number of species.

To refer only to plant life, the lowly toadstool grows as a parasite on decaying vegetable matter, while the herbaceous beauties of cow-wheat, eyebright, and such like obtain their food from the neighbouring grasses. They, however, attach themselves to these roots after the seeds have germinated in the ground, and as growth proceeds the rootlets of the young plants fasten on to the grasses, and utilise their roots to supply nourishment. A similar springing into active life before getting their food from others belongs in fact to all the British parasites. The exception is the Mistletoe, and looked at in this way the Mistletoe is the most degenerate of all our parasitic plants, because its seeds germinate on the living tissue of its host, and make no attempt to start life in the ground like the others. It has selected trees as its host, and in time will impoverish the most vigorous branch, in the same way that other plant parasites injure the hosts on which they have made their home.

The Mistletoe lives on year by year and grows slowly, apparently needing the sap of trees to supply its nourishment. The reason of this need cannot be decided so far, and Darwin held strong views about the selective power of plants, and characterised it as preposterous to claim any one cause for their parasitic habit. He, and others since his time, have assigned many reasons why a variety of causes must be weighed before being tied down to one. This much, however, can be said of the Mistletoe's selection of particular kinds of trees, that a comparison of the outer coats of their branches shows that all of them are covered with a soft, sappy tissue. Through these soft coatings the pegs or roots given off by the Mistletoe seeds can readily penetrate, and at once enter upon a food supply of sap. The way then that the Mistletoe begins its life is by the naked seed germinating directly on the tree, and how it gets to a suitable place on the bark, and how it continues its growth, present many interesting features.

The berries when ripe are round, and contain a solitary seed completely enveloped in a thin glutinous pulp, which is eagerly eaten by birds, notably the missel thrush (hence its name) and the blackbird. These belong to the order of fruit-eating birds, which do not grind up their food in their crops, so that the seeds after passing through the bird still retain the power to germinate.

This method, by which the Mistletoe is dispersed, would seem to have been noticed in ancient times, because the derivation of its name is stated by Skeats to be taken from the Scandinavian word "mist," meaning dirt, in reference to the manner of distribution by birds. Other authors, it is true, go back to an equally early period and connect the name with the Anglo-Saxon "missel," different, and thus think it would mean a different twig to the branch on which it grows.

The idea that the Mistletoe seed clings to the beak of the bird, when feeding on the berries, and is rubbed off by it on to the

branch in order to rid itself of a nuisance, does not seem to be capable of proof, although it is popularly believed to be the means of dispersal.

Whichever derivation is chosen, it is by means of birds that the seeds are deposited on neighbouring trees, and, in most instances, perish for want of suitable conditions. A stray seed here and there, however, lodges in some crack on the bark or in the roughened coats where a branch is given off, and remaining there in security is able later to force its roots into the next layer of soft wood below. It thus soon reaches a good supply of food, because this layer immediately below the bark is specially full of sap, being the one by which the tree makes active growth each year. Once having started to grow the little roots or pegs increase in length until they find the firm woody tissue of the branch, and there they cease to penetrate. The pegs possess the power to elongate themselves at their base instead of at the tip, and in that unexpected way add to their length. It is the host which grows thicker each year, and as it increases it envelopes the pegs upwards, so that they become surrounded more deeply by woody tissue and are firmly fixed. Meanwhile the Mistletoe gives off new rootlets immediately under the bark, and these in their turn send out fresh pegs to penetrate to the hard wood and to be enveloped in due time by the increased growth of the branch. By cutting open a branch carrying a well established bunch of Mistletoe, it will be seen that the root pegs are arranged in a row—they have been compared to the teeth of a garden rake, and they enter at the side of the branch.

Having established its growth by rows of pegs within the tree, the visible portion of the Mistletoe plant outside the bark proceeds in its turn to develop. It may be years before it makes much promise of a bush, according to the amount of food which its host is able to provide. As it increases its bark becomes of a light green colour, and its leathery leaves also take on a greenish tint, both caused by the presence of the green chlorophyll within the cells. This chlorophyll helps to make a supply of food, just as it does on a much larger scale in the green leaves of other plants, so that the Mistletoe is not entirely dependent on the sap of the tree for all its food.

It is on account of this partial supply that the Mistletoe is not, after all, the worst form of parasite, like the dodder or broomrape that have no green leaves, but it still remains to be considered botanically a degenerate plant.

The Mistletoe originally produced all its own food, but having acquired the habit of getting free meals from a liberal host, it has gone a long way towards losing its independence, and only helps itself by forming a limited amount of chlorophyll in its leaves. Such a downward course might be imagined in the ivy and the Virginian creeper, where we have examples of plants that send forth rootlets by means of which they cling to walls or trees. They obtain no food from them, yet it would be easy

to think that in some species these rootlets, under favourable conditions, might start on a parasitic existence and adapt themselves to drawing sap from their supporting trees, and so set up a scheme of feeding at another plant's expense.

Other speculations arise in one's mind concerning the Mistletoe. When one looks at the different sorts of trees on which it grows, and we know from observation that it flourishes successfully on each of them, we may wonder how it manages to assimilate the various kinds of sap that form its food. The property common to all the trees on which I have found it is their astringency, which is allied to tanning material, and that property in its turn is acquired by the bark of the Mistletoe.

A learned authority states, however, that the ash of the plant shows quite a different chemical result from that of the host, so the Mistletoe must possess the ability to rearrange and make use of the saps for its own requirements, and be a skilled master in gathering the best from each kind of tree. The greenish flowers which appear in March are very inconspicuous, of two sexes, borne on separate plants. The golden pollen from one is carried by small flies to the sticky ovary of the other, which becoming fertilised produces the familiar berry. When the fruit is fully ripened it has turned from a light green to a whitish colour. This is not the dense white that is seen in the snow-berry or in flowers, caused by air in the cells, but a clear semi-transparent white, such as is found in the garden currant. The advantage of the colour to the Mistletoe lies in it causing the fruits to be conspicuous against the brown or grey background of the leafless branches, and, in this way, they are more easily seen by birds, so as to afford them food, and by their short flights to transfer the seeds to neighbouring trees.

The general distribution of a plant is often described by the botanist as "common," "local," or "rare," and on these lines the Mistletoe would be classed as "local," because, although it is fairly frequent on different trees in some places, in others it is rarely seen except in some old-established orchard. The wide and extensive Nailsea valley, from Bristol to Yatton, is a district where it grows abundantly, and it is in this portion of the Bristol coalfields that my observations have been chiefly made. There I have seen it without much difficulty in nearly every orchard, and on nine other species of trees, whereas elsewhere in Somerset it seems to be limited almost entirely to apple trees, with an occasional poplar or hawthorn. The trees that act as hosts in the Nailsea valley are the sycamore and maple; the crab-apple, hawthorn, white beam, and pear; the acacia, lime, and poplar.

These trees belong to six different orders, which shows that the Mistletoe is able to make itself at home on trees that differ considerably in their characters. It must not be thought that on these trees it can be met with only here and there, because

it is distinctly common on some of the species, notably on a grove of sycamores, on three long avenues of limes, and on several scattered acacias, maples, and hawthorns. One or two of the clusters are so uniform in shape that they look like a chandelier of green hanging from a slender bough, and can readily be seen by the most casual observer. On the white beam it is confined to one bush in Brockley Combe as far as is observed, and it is admittedly regarded as very rare on that host. When the plant is found thus plentifully distributed over a limited area and is comparatively rare elsewhere, the interest in its growth is much increased, and comparison is thought of with other counties where it flourishes.

On the Gloucestershire side of the city it is scarce except on the apple and poplar, but we find it established on two additional trees, the grey poplar at Brentry, and a species of sugar maple planted in Tortworth Park, as well as on a few hawthorns, including a small plant on Durdham Down. Further observations, however, are needed for the county, and I commend the work to the notice of the members.

Herefordshire stands out pre-eminently as the home of the Mistletoe in England, and the few species of trees on which we find it locally compare poorly with the 32 different kinds which have been observed by botanists throughout the county. With so many orchards there the number of Mistletoe berries distributed each year must be very great, but the explanation of its frequency on so many different trees must be chiefly due to some unknown conditions favourable to the plant, which must exist in a more limited extent in Somerset and only within such a small district as the Nailsea valley.

The 32 different trees in Herefordshire consist of a number of species, many of them cultivated or foreign, but confined to a few Natural Orders, so the same law seems to apply, that it is only trees with special tissues which can act as hosts to this strange parasite. Just as with us the Mistletoe cannot be found on some of our commonest native trees, so in that county it does not grow on the beech, the silver birch, the hornbeam, the sweet chestnut, the holly, the blackthorn, or the elder, and, taking all the conditions into consideration, we may feel gratified with the display that is made close around Bristol.

From the flora of Glamorgan we gather that the parasite is very rare in that county, and it is stated on good authority that not more than half a dozen solitary clumps have been noted throughout the whole of Glamorganshire, and no satisfactory explanation is forthcoming for this curious limitation of the plant. Apple trees and poplars, at all events, are plentiful there, and yet for some peculiar reason Nature refuses to permit the parasite to gain a footing on them.

On broad lines of distribution, it is known that the chemical composition of the soil greatly influences the kind of plants that

grow on it, as on limestone around us, or on sandstone in parts of the Mendip Hills, or on the alluvium salt marshes by the Severn. Now a glance at the geological map shows that in Herefordshire the geological formation is chiefly of sandstone, and although Glamorganshire contains a similar rocky soil with much of the limestone and coal measures added, yet on similar soil the Mistletoe is remarkable by its absence. Another factor which influences the distribution of plants is the direction in which the hills slope, whether towards the north or elsewhere, so as to modify the amount of rainfall and sunlight, but this does not seem to apply to the hilly counties under view.

The only suggestion that I can offer is that when the fruits are ripe about mid-winter the migration of thrushes and black-birds takes place to the lower and warmer plains, and the birds may travel away from the Welsh hills towards the south-west, and so over long periods may carry the seeds only in that direction.

You will have noticed my list of trees bearing the Mistletoe did not include the oak. It was purposely omitted, because it needs a more extended mention.

The oak and the Mistletoe have always been associated in popular story and in history, because our Anglo-Saxon forefathers in England and in the north-west of France made the Mistletoe growing on the oak a sacred plant, and one of the chief points around which their whole religion centred. In modern times it is exceedingly rare for the oak to be found bearing Mistletoe, and the Druids must have experienced the same lack of such oaks, for Nature does not change in that way, and would have limited the number to them as she does for us. For many years it was thought that there were only seven oak trees in all England that bore the Mistletoe, but a more careful search at the end of the last century was rewarded by the discovery of three more such trees in Herefordshire, and one of these has an added interest to us, because it was made by a former Vice-President of this Society, the late Mr. Charles Fortey, when resident at Ludlow, before making his home in Clifton. Parts of Gloucestershire also are fortunate, for such an oak is on record at Frampton-on-Severn, and at Sedbury near the Monmouthshire border, but including these, the whole of England could boast of knowing only ten oak trees on which the Mistletoe grew.

Recognising, then, the interest that attaches to a Mistletoe-bearing oak and its scarcity, the members of this Society will be gratified to know that within the last month I have found a splendid example in our own immediate neighbourhood, and I have much pleasure in giving to them the first information of the discovery.

In the Leigh Woods, in that portion to which the public have free access, and facing the Avon Gorge, there is a lofty oak tree, the species *Quercus intermedia*, which has near its top and some

fifty feet from the ground, a magnificent bunch of Mistletoe, that must be the growth of years. Having thus obtained our own Mistletoe on the oak, it may be a justification to mention some of the early associations that cling around the plant. The history of the Mistletoe goes back to Pagan times, and is mentioned by the Romans at the beginning of the Christian era.

But it is amongst the people of Northern Europe that its mystic characters were so prominent. In England, long before the coming of the Romans, the Mistletoe was the sacred plant of the people, and was held in the greatest reverence by them in conjunction with the Druids, who were their Priests or "medicine men," to use the title given to the religious leaders of more recent savage tribes. The Druids, we are told, worshipped in groves of oaks, and, considering the rarity of the Mistletoe, we must assume that when they knew of a wood wherein it grew on an oak they looked upon it as a sacred spot, in the same way perhaps as we regard our Cathedrals as the centre of religious life. They marched with great solemnity into such a wood at mid-summer and mid-winter, dressed in white garments and followed by a choir of chanting voices to collect the Mistletoe from the oak. The Arch-Druid himself mounted the tree, and, with a knife of pure gold, cut off a bough and dropped it into a white cloth held up to prevent the "heaven descended" plant coming in contact with the earth.

After numerous rites and feastings the sacred emblem was distributed and kept as a charm against sickness and evil spirits.

Modern research into the primitive worship of the nations of Europe has shown that the people considered the spirit or soul of a tree so far helped in its growth that the shedding of the leaves in autumn was a sign of death, and the putting forth of a fresh crop of leaves in the following spring was a coming to life again of the spirit of the tree. A Mistletoe bough, flourishing with its green leaves and glossy white berries amidst the bare branches of the oak, appeared to these superstitious people as the visible sign of the immortal part of the tree, which protected its life through the apparent death of winter. Thus the ever-green Mistletoe became an object of special reverence, and was worshipped as the very soul of the whole forest.

There is nothing fantastic in this idea of the external soul, because on many of the painted frescoes, brasses, and monuments that are left in our churches it is not uncommon to see a representation of the soul of the departed being carried by angels to Heaven in the guise of a little figure in human form. In this manner the oak, with its strange-looking companion, appealed to the minds of the nations, and when Christmas-tide became a religious festival to the English people after their conversion from Paganism, the Mistletoe continued to be a decoration for their joyous sports, although banished from their churches as being something irreligious and pertaining to cruel rites and sacrifices.

You will find in many of the published accounts of Bristol Cathedral the statement that the carving round one of the Berkeley recesses represents the Mistletoe, and is the only example of the plant in English church architecture. This is a mistake. The plant in question is a branch of maple with its winged fruit pods, distorted at some partial restoration by an ignorant craftsman to the resemblance of the berry and twin leaves of the Mistletoe. For centuries after the religious ceremonies of the Druids had ceased the Mistletoe passed out of use at Yule-tide, and it is only within the last 200 years that any reference is made in literature to the shrub as a decoration at that season.

Interest in the plant has been kept alive by many of the minor poets, but I cannot find that they make more than a passing allusion to it, such as is recognised by every one.

Its mode of growth, "'twixt heaven and earth," exercised the minds of the Elizabethan writers. Shakespeare alludes to it but once, and, describing it as "the baleful mistletoe," shows that he recognised its pernicious growth. Tennyson calls it "the sacred bush," and the early herbalists tell of its wonderful medicinal virtues, which, however, have lost their esteem in modern science, and the viscid fruit is now chiefly used in making fly-papers.

Some of you may recall a picture by Turner in the National Gallery, painted about 1834, that was inspired by the plant. It is named "The Golden Bough," and depicts in gorgeous colours a small lake amidst Italian mountain scenery, with some graceful female figures moving about in joyous life. One of these has just cut with a sickle a bough from a stone pine, and holds it aloft to catch the rays of the sun, which turn it to the brightest gold. The whole picture was inspired by a passage in Virgil, that compares such an illumined bough in the *Inferno* to the Mistletoe, which, as you know, often assumes a yellowish hue in winter time; and the fanciful name of "Tree of pure gold" still clings to it amongst the Welsh.

In Scandinavian history the Mistletoe has always had a mystic and religious meaning. In some of the poems of that country, written before the people gave up their many Pagan gods to adopt Christianity, an account is given of the death of Balder, chief of all the gods, killed by an arrow made from a bough of Mistletoe. He was under the protection of the spirits of the earth and air, fire and water, who had promised that, through them, no harm should come to their god, but the Mistletoe, which sprung from none of these, had been overlooked, and so was used as a weapon by the spirit of evil to prevail against his enemy. But the enchantments of the gods were all-powerful, and through them Balder was brought back to life, and to prevent further mischief from the Mistletoe the plant was henceforth placed under the control of the Goddess of Love.

From this poem it has been sought in modern times to derive the justification for kissing under the mystic bough at this season of the year, but it is not needful to enter into that portion of its history whilst addressing a serious and scientific Society.

The following records of Mistletoe have been made since the publication of the "Flora of Bristol," 1912 :—

Ash—S. Barrow Gurney.

Crab Apple—

G. Littleton-on-Severn.

S. Chelvey Batch.

White Beam—S. Brockley Combe ! *F. Samson*.

Himalayan Birch (*Betula Jacquemontii* Spach). S. Tyntesfield !
C. Bucknall.

Hawthorn—

G. By the river, Westbury-on-Trym ; Tortworth Park ;
Thornbury ; Littleton-on-Severn.

S. Ashton Park ; Tyntesfield ; West Town, Backwell ;
Wrighton Hill ; Yatton ; Chew Magna.

Common Lime—

G. Old Down ; Thornbury.

S. Tyntesfield ; Bourton Combe ; West Town, Backwell ;
Saltford ; Chew Magna.

Maple—S. Wrighton. Kelston.

Norway Maple (*Acer platanoides* L.)—S. Brockley.

Sugar Maple (*A. saccharinum* L.)—G. Tortworth Park.

Oak (*Quercus intermedia* Boenn)—S. Leigh Woods.

Pear—S. Flax Bourton ! *G. H. Wollaston*.

Ontario Poplar (*Populus tacamahacca*. Miller)—G. Littleton-on-Severn.

Robinia—S. Long Ashton ; Tyntesfield ; Wrighton ; Saltford
Golf Links.

Sycamore—S. Bourton Combe.

The Carboniferous Limestone Series of the Area between Clifton and Clevedon.

By S. H. REYNOLDS, M.A., Sc.D., F.G.S.

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- II.—RELATION OF THE CARBONIFEROUS LIMESTONE SERIES TO THE OTHER ROCKS.
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I.—INTRODUCTION.

(a) *Previous Work.* The chief faults and the general arrangement of the strata are described in Buckland and Conybeare's classical memoir entitled "Observations on the South Western Coal District of England."¹ The more important exposures were described with lists of fossils by Vaughan in his paper on the Carboniferous Limestone of the Bristol Area,² while additional information concerning the Avon Section was given in that on "The Carboniferous Limestone Series (Avonian) of the Avon Gorge."³ One paper by Prof. Lloyd Morgan in the Quarterly Journal of the Geological Society⁴ and three in the Proceedings of the Bristol Naturalists' Society⁵ refer to this district; as does a paper in the Geological Magazine,⁶ by Mr. F. Dixey. The beds are alluded to in the following pages under the names applied to them by Vaughan.

(b) *Extent of the Area.*—The district described, which has a length of about $8\frac{1}{2}$ miles, extends from the Avon Gorge at Clifton to the Trias-filled valley between Court Hill and Strawberry Hill, Clevedon. The main part of this area is a fairly level plateau, generally about a mile wide and with a height usually between 425 and 475 feet. The western part forms a narrow ridge and its height is less than that of the eastern part.

¹ Trans. Geol. Soc., 2nd ser., Vol. I. (1824), pp. 210-316.

² Q.J.G.S., Vol. LXI. (1905), pp. 181-307. This paper will be referred to in the following pages as "Bristol paper."

³ Proc. Bristol Nat. Soc., 4th ser., Vol. I., 2, (1906 issued for 1905), pp. 74-168. This paper will be alluded to in the following pages as "B.N.S. paper."

⁴ Q.J.G.S., Vol. XLI. (1885), pp. 146-151.

⁵ "Sub-aerial Denudation and the Avon Gorge," n.s., Vol. IV. (1884), pp. 171-197; "The Millstone Grit at Long Ashton," *ibid*, pp. 163-165; "The Portbury and Clapton District," n.s., Vol. V. (1885), pp. 1-16.

⁶ N.S. Dec. vi., Vol. II. (1915), pp. 312-316.

II.—RELATION OF THE CARBONIFEROUS LIMESTONE SERIES TO THE OTHER ROCKS.

From the eastern limit of the area in the Avon valley, along its northern boundary nearly as far W. as Nash House, the Carboniferous Limestone rocks rest conformably on the Old Red Sandstone, the shaly K-beds (Lower Limestone Shales) occupying a marked depression between the limestone plateau to the S., and the irregular but often fairly high country formed by the Old Red Sandstone to the N. From near Nash House westward to the end of the area the northern boundary is a faulted one,¹ the Clapton Fault bringing the Coal Measures of the little Clapton-in-Gordano Coalfield against the Carboniferous Limestone. The fault cuts out the K-beds.

Except for a distance of about a mile near Nailsea, where the Coal Measures are in contact with the Carboniferous Limestone, the limestone plateau everywhere rises somewhat steeply from the Triassic lowland to the south. As is the case elsewhere in the Bristol district, the conglomeratic base of the Trias (Dolomitic Conglomerate) extends as tongues up the pre-Triassic valleys in the limestone, and patches of it are met with high up on the plateau, occasionally as to the N. of Tyntesfield farm and in the western part of Ashton Park, reaching a height of over 400 feet. The 1-inch Geological Survey map has been in the main followed in indicating the position of these tongues and patches on the accompanying map.

Near Long Ashton on the southern boundary, and near Clapton-in-Gordano on the northern, small inliers of the Carboniferous Limestone Series appear through the newer rocks.

III.—FAULTS.

The Clapton Fault.—The important fault forming the northern boundary of the Carboniferous rocks westward from Nash House has already been alluded to. It is shown in the 1 inch Geological Survey map and was described by Buckland and Conybeare as follows² :—

“The western half of the chain, from Clevedon to near Portbury, presents remarkable anomalies along its northern escarpment. The local phenomena are such, as clearly indicate that a great fault ranges along the edge of this part of the escarpment, affecting a very considerable subsidence of the strata, so that the coal-measures, depressed to the level of the old red sandstone, appear to occupy its place, and seem to dip beneath mountain limestone, on which, in fact, they repose. The limestone beneath the coal-measures having subsided as well as the coal-measures themselves, on re-emerging forms a second calcareous ridge, called Walton Down, to the west of Leigh Down though not parallel to it. . . . The anomalous appearances attending this fault are well exhibited in the northern part of the

¹ See following sections.

² Trans. Geol. Soc., 2nd ser., Vol. I. (1824), pp. 238-239.

ravine traversing Leigh Down at Sir A. Elton's Park.¹ After passing the limestone, which bounds the ravine towards the south, the sides abruptly change to the Pennant coal-grit, full of coaly matter dipping southward, in the same direction as the limestone, and apparently beneath it. . . . To the east of the ravine the coal-grit occupies the escarpment of Leigh Down for the space of 4 miles, as far as the coal mines of Clapton, beyond which it is concealed beneath the marshy plain. In this interval the stratification of the coal-measures is very much disturbed, but their general dip is southerly, towards the fault."

Mr. F. Dixey, on the other hand, in the paper referred to above, regards the line of junction of the Coal Measures and older rocks S. of Clapton as an unconformable one. He says² :—

"In the neighbourhood of Clapton in Gordano the southern boundary of the Coal Measures transgresses the outcrop of the Carboniferous Limestone, the Lower Limestone Shale, and the Old Red Sandstone, and the Coal Measures enclose several small patches of Carboniferous Limestone. Moreover, whereas the Lower Carboniferous and older strata possess a variable but persistent southern dip, the Coal Measures dip to the north and north-west."

While there can be no doubt that Vaughan was right in considering that the Coal Measures in relation to the isolated patches of Carboniferous Limestone near Clapton rest directly on the limestone, the Coal Measures certainly have not always a northerly or north westerly dip. In the best exposure, that of Conygar quarry the dip is 25° S.E. and at Clevedon Cottages 30° S.E., in each case if no fault intervened the Coal Measures would pass below the Carboniferous Limestone, which lies not many yards away to the S. Further to the E. the relations are less clear and the dips vary, but Buckland and Conybeare's statement (p. 239) that while the strata are very much disturbed the general dip of the Coal Measures is southerly is probably correct. Hence I agree with Buckland and Conybeare, with Prof. Lloyd Morgan, and the Geological Surveyors as to the faulted character of the Carboniferous Limestone boundary to the W. of Nash House.

The Observatory Hill Fault. — The reversed fault of Observatory Hill, Clifton has been described by many geologists, the latest being Prof. Lloyd Morgan³ and Dr. Vaughan.⁴ Its most remarkable feature is the rapidity with which it dies out when followed N.W. Prof. Lloyd Morgan's map shows it extending as far as the Old Red Sandstone of Failand. I am inclined to think it dies out somewhat sooner than this, and to trace its course somewhat to the S. of Prof. Lloyd Morgan's line. After leaving Leigh Woods, where it does not follow Nightingale Valley but passes well within the limits of Stokeleigh Camp, the fault crosses the road somewhat to the S. of Beggar's Bush

¹ i.e., that between Strawberry Hill and Court Hill, Clevedon.

² p. 313.

³ Proc. Bristol Nat. Soc., n.s., Vol. IV. (1884), pp. 185-189 and Q.J.G.S., Vol. XLI. (1885), pp. 146-151.

⁴ B.N.S. Paper, p. 88.

Corner. As pointed out by Prof. Lloyd Morgan, it cuts the strata somewhat obliquely, with the result that as it is followed westward lower and lower strata are brought in contact with one another till the fault dies out. In the Avon Valley S₂ is brought over D₂, in the field to the W. of Beggar's Bush Corner the *Caninia*-Oolite (C₁) is brought over S₁, which is much crushed and veined. Upper Farm (Hill Farm) stands on the *Caninia*-Oolite, and a second development of this horizon is seen in an old quarry about 300 yards W. of the Farm. The repetition is clearly due to the passage of the fault, which, I believe, here brings the Laminosa Dolomite (lower C₁) over the *Caninia*-Oolite (Upper C₁). I attribute the strong contortion of the Z-beds in the old quarry to the E. of the road and about 250 yards S. of Yew Tree Cottage, and the discordant dips just W. of the road, to the fault, and have not found traces of it further W. Prof. Lloyd Morgan has also alluded to the disturbed condition of the strata as indicated by the confusion of dips at this locality.

Cross Faults.—The strata are further traversed by a series of cross faults (see map). Those to the E. of Nash House shift the outcrop northward, while those further W. shift it southward.

IV.—DESCRIPTION OF THE EXPOSURES.

(1) *The Cleistopora (K) Beds.*

The only complete section of these beds in the whole area is in the Avon Valley, where the exposures were fully described by Vaughan. Elsewhere the beds are only seen in occasional outcrops of the harder bands, especially of the Bryozoa-bed.

The line of outcrop of the K-beds is throughout marked by a deep depression which passes just to the E. of Abbot's Leigh, then S.W. to Yew Tree Cottage, and westward pass the Failand Golf Course to Failand Farm. There a fault shifts the outcrop northward, and the depression extends from Funny Row along Ox House bottom to Failand Hill House. Here a second fault shifts the outcrop northward, and the depression may be followed to Racecourse Farm, where a third fault shifts the strata yet further to the N., and the depression extends through Charlton House Deer Park and Moat House to end near Nash House, where the Pennant Sandstone is faulted against the Carboniferous Limestone series.

The exposures may be quickly described. Small quarries in the Bryozoa-bed having the usual character of a red crinoidal limestone occur on both sides of the road leading through Fish Pond Wood, Abbot's Leigh. The western exposure shows also crystalline and fossiliferous limestone below the Bryozoa-bed. The same band of limestone, here coarsely oolitic, was exposed in 1917 in a trench dug at a point near the edge of the wood $\frac{1}{3}$ mile N.E. of the church, in connection with a volunteer camp held in the Old Park, Abbot's Leigh. Thin-bedded limestone with bryozoa and *Camarotoechia mitcheldeanensis* was thrown

out in making a small pond about 300 yards W.S.W. of Yew Tree Cottage. The Bryozoa-bed resting on a thick band of compact, largely oolitic limestone, gritty in places, is exposed at two points near Funny Row, W. of Failand Farm, and thick shales are seen at the western end of the footpath leading W. from Funny Row. Several exposures of thin-bedded limestones of K-type are seen in the neighbourhood of Ox House Bottom. The old trial shaft of the Portishead Water Works, Lower Failand, penetrated the lower part of the K-beds before entering the Old Red Sandstone, as is seen from the debris thrown out. The quarry at the bend of the road near Failand Hill House was determined by Vaughan (Bristol paper, p. 215) as hor. β , the rock contains much chert. The K-beds are fairly well seen in the Failand road section (described by Vaughan¹) for some 300 yards to the S. of Racecourse Farm. The Bryozoa-bed is exposed in the farmyard. The zonal fossil *Cleistopora geometrica* has been found in this section.

An excellent section of part of K, including the Bryozoa-bed, is seen in an old quarry 300 yards E. of Charlton House. The section is as follows:—

	ft. ins.
4. Bryozoa-bed, red crinoidal limestone	4 6
3. Shale parting	3
2. Limestone interbedded with thin-bedded flaggy bands	2 6
1. Limestone compact at the top, but in the main coarsely oolitic and crinoidal, including also gritty bands and coarsely crinoidal non-oolitic bands	6 6
	13 9

Band 1 in the above section is also well exposed in a small quarry S.E. of Combe Cottage, a small farm lying W. of the Portbury road and $\frac{1}{4}$ mile N.W. of Racecourse Farm. The upper beds here are strongly oolitic, the grains being partly ironshot, the lower crinoidal and less markedly oolitic. The coarse oolite seen here and at Abbot's Leigh is closely similar to a band of rock occurring at the same level in the Burrington Combe section, but not hitherto met with anywhere else in the Bristol area.

Passing westward no exposures of K-beds were met with till the Bryozoa-bed was found at the southern end of Bullock's bottom, a wooded valley $\frac{1}{4}$ mile N.N.E. of Moat House Farm. A highly fossiliferous development of K 2 is seen by a little pond about the same distance N.W. of Moat House Farm. Before the Clapton road is reached near Nash House the K-beds are faulted against the Pennant Sandstone, and are seen no more in the area which is the subject of this paper.

¹ Bristol Paper, pp. 214-5.

(2) *The Zaphrentis (Z) Beds.*

Apart from the Avon quarries, the first important exposure of the Z-beds as one passes westward is the quarry by the road at Abbot's Leigh described by Vaughan.¹ Here the Z 1-beds, which are very shaly at the base, are well exposed.

South-westward from this point for a distance of $1\frac{1}{2}$ miles, i.e., nearly as far as Failand Farm, the Z 1-beds form a rather prominent escarpment marked by a narrow band of wood; exposures are plentiful and the rocks are, as is usually the case with Z 1 in the Bristol area very fossiliferous. The Z-beds are also exposed to the E. and W. of Manor Farm. The Observatory Hill fault appears to die out in the Z-beds near Yew Tree Cottage. There are many exposures of Z-beds near Failand Hill House; at the northern end of the grounds below the summer house there is a good section of Z 1, and a wooded scarp of this horizon extends westward along the northern boundary of the warren known as the Horse Race to the road S. of Racecourse Farm. Z 1 material crowded with *Leptaena analoga* was thrown out in making a pond near the S.E. corner of the Horse Race. In the road section S. of Racecourse Farm the whole of the Z-beds are well seen, Z 1 in the road section and in the woods E. and W. of the road, Z 2 and γ in the Horse Race quarry.² No more exposures of importance are seen as one proceeds westward till the Moat House Farm quarries described by Vaughan³ are reached, the horizon being upper Z 1 and lower Z 2. The same beds are seen at several points between Moat House Farm and the Clapton road.

Z 1-beds were temporarily exposed in 1916 just to the E. of Nash House, within a few yards of the Pennant outcrop.

The woods to the N. and S. of the track to Cadbury Camp are mainly in Z-beds, and numerous exposures of highly crinoidal limestone occur. The remarkable isolated patches of limestone appearing through the Coal Measures in the neighbourhood of Clapton-in-Gordano are also of Z-beds.

Z-beds are well seen in places in the south-western part of the moat of Cadbury Camp, and the abundance of *Leptaena analoga* in the loose material along the northern margin indicates the presence of Z 1. All the country as far N. as the Clapton road, a distance of some 500 yards is composed of Z-beds. This width of outcrop implies repetition of the strata either by folding or strike-faulting. The narrow flat-topped ridge which extends westward from Cadbury Camp for some $2\frac{1}{2}$ miles to end at Court Hill, Clevedon, is mainly composed of Z-beds, which are exposed at many points along the course of the outcrop, and particularly in the path leading up Court Hill from near All Saints' Church, Clevedon.

¹ Bristol Paper, p. 233.

² Ibid, pp. 215-6.

³ Ibid, p. 232.

(3) *The Syringothyris (C) Beds.*

With the exception of the *Caninia*-oolite, the rocks of this horizon are not often well seen. No exposures of importance are met with between the Avon quarries and the Abbot's Leigh road. The *Caninia*-oolite and base of the overlying dolomites were exposed in 1916 in some military trenches in the field S.W. of Beggar's Bush corner, and the narrow woods stretching N.E. and S.W. from Upper Farm stand on the oolite which is frequently exposed. The Observatory Hill fault passes near Upper Farm, the exposure just alluded to lying to the S. of the fault, while an old quarry about 300 yards due W. of the Farm is in the *Caninia*-oolite N. of the fault. The *Caninia*-oolite is further exposed in the large quarry near the eastern end of Wraxall Piece, and after the outcrop has been shifted N. by a fault, at several points on the north-western border of Wraxall Piece and at one near the N.W. corner of Sixty-acre Plantation.

The *Laminosa*-dolomite is rarely seen, but a small exposure of the base of this horizon and of the top of horizon γ occurs nearly opposite the farm E. of Failand Lodge. The *Caninia*-oolite is also seen in an old quarry S. of the Clevedon road and opposite the end of the road from Lower Failand.

Immediately to the W. of this quarry a fault shifts the outcrop northwards, and to the W. of it the outcrop of the C-beds widens. The *Caninia*-oolite, which remains the only horizon commonly exposed, is well developed in the old quarries at Charlton Cottages, and is seen at several points near the road to the E. of the cottage called White House, where the Clapton and Tickenham roads diverge from one another. There is also a quarry in this band S. of the point where the track to Cadbury Camp leaves the main road. The tract of country formed by the C-beds extending westward from Charlton Cottages yields a more fertile soil and is more cultivated than is usually the case locally with the Carboniferous Limestone.

To the W. of the fault running from near Nash House to Birdcombe Court the outcrop of the C-beds widens considerably and there is more than one possible explanation of this. Before considering these, the exposures, which are not numerous, will be described. The outcrop of the *Caninia*-oolite may be traced from near the southern end of Mogg's Wood, where it is well-seen both E. and W. of the wood past Tickenham House to the western end of Summerhouse Wood, where it is again visible. Along the valley to the N. stretches a tongue of Trias, and to the N. of this is a further series of exposures in white, more or less oolitic limestone, one at the south western corner of Chummock Wood, a second in the south-eastern corner of Sir John's Wood being in a foraminiferal limestone crowded with *Calcsiphæra*. Nearly on the same line of strike are exposures of white oolite on the north-eastern side of Cadbury

Camp. There are two possibilities with regard to these oolitic bands:—(1) That they are two distinct bands, (2) that they are repetitions of the same band. According to the former hypothesis the lower band would be in horizon γ or the lower part of C 1, and a considerable increase in the thickness of the C-beds as compared with their development further E. would be implied. According to the second hypothesis the outcrop of the C-beds is widened either by a strike fault or by a roll in the strata, either of which might be hidden under the tongue of Trias alluded to above, which strikes north-eastwards from Tickenham to a point S. of Nash House. The latter hypothesis is the more probable, though definite fossil evidence is lacking.

A fault passes through Cadbury Camp, and the *Caninia*-oolite is next seen on the slope to the S. of the camp. From this point westward it is not again met with till the western limit of the area under consideration is reached at Court Hill, Clevedon. Here, however, the *Caninia*-oolite is exposed at Court Farm.

(4) Horizon Δ^1 (*Bellerophon* Bed).

Horizon Δ , that of overlap between the C and S-beds, is so well marked as to merit a special description. Passing westward from the Avon Section, it is first seen in a new quarry just inside Leigh Woods and opposite the end of Beggar's Bush Lane. Here it is a massive partly dolomitised grey oolite weathering reddish and containing rounded pebbles of oolite, apparently due to pene-contemporaneous erosion. A fish-tooth (*Psephodus*) was the only fossil found at this spot. A band of white oolite runs parallel to Beggar's Bush Lane, and is exposed at many points along the northern margin of Ashton Park. This band is on the strike of the oolite at Beggar's Bush Corner, and is doubtless the same band, though not quite identical lithologically. When the western limit of Ashton Park is reached the rock again has the character of a fairly coarse oolite tending to weather reddish. The long narrow wood, after which Longwood House is named, stands on this oolite, and it is fairly well exposed and crowded with gastropods at the eastern end of the wood. Further W. it is seen in the *Bellerophon*-quarries described by Vaughan,² the eastern being on the border of Wraxall Piece and W. of the road to Failand Farm, the western to the S. of Failand Inn. The next point where the band is seen is $1\frac{1}{2}$ miles to the W., by the side of the footpath leading from Sidelands Cottages to Parsonage Farm, Wraxall. The same band, shifted by a fault, is seen in an old quarry by the field path which runs parallel to Wraxall Hill and about 300 yards to the E. of it. Two-thirds of a mile further W. the band, retaining its character as a reddish oolite

¹ Vaughan's original use of the term horizon Δ is followed, not his later use (Q.J.G.S., Vol. LXXI., 1915, pp. 17-24.

² Bristol Paper, pp. 212-213.

with many gastropods, is seen in the lane which runs northwards from Ham Farm across West Hill, Wraxall, and also opposite the turning to Nash House from the Tickenham road. Several exposures occur at Stone Edge Batch, one in the road S. of the Baptist Chapel and a second a short distance down the turning which leaves the high road $\frac{1}{4}$ mile W. of Tickenham House.

Westward from Stone Edge Batch for rather more than a mile the outcrop is covered by Trias, but at Middletown the horizon is well exposed in a quarry which was described by Vaughan,¹ who gives a list of fossils. The rock retains the oolitic character.

(5) *The Seminula (S) Beds.*

The outcrop of the S-beds extends from the river Avon through Leigh Woods to the Abbot's Leigh road, beyond which the rocks are soon cut across by the Observatory Hill fault. Good exposures of S1 were made in 1916 in military trench digging in the field S.W. of Beggar's Bush corner, the highest beds being nearly unfossiliferous china-stones, very much crushed and clearly indicating the proximity of the fault, while below are compact limestones with abundant *Seminula* and *Lithostrotion martini*.

The S-beds as repeated by the fault are exposed in the cliff forming the southern boundary of Nightingale Valley, and at various points near the top of the slope on the northern side. They are seen also in several old quarries in Leigh Woods, e.g., one opposite Burwalls, where they include shales, china-stone, and *Seminula*-bands, a second opposite Rownham House, where the *Seminula*-oolite is seen, and a third near the top of the path through Nightingale Valley.

S-beds extend all through Ashton Park, forming a broad plateau which slopes slightly towards Beggar's Bush Lane. Exposure are not numerous, but there are several old quarries in limestone of the usual *Seminula*-bed type with china-stone and abundant *Lithostrotion martini* and *Seminula*-bands. Two large quarries in S-beds are situated near the south western corner of Ashton Park,—in the angle between the Long Ashton and Providence roads there is a large quarry in the upper S-beds, while just to the N. of the Longwood House road there is another in S1, in which the *Seminula*-oolite is seen underlain by massive limestone with *Lithostrotion martini*. In the former of these quarries the rocks are folded into a sharp anticline, the arch of which is traversed by a line of crush, which when prolonged southwards, leads to a remarkable line of swallets (miscalled old quarries in the 6 in. map) in the Long Ashton Golf Club grounds. The anticlinal fold is also apparent here, the rocks at the swallets dipping at 25° S.E., while a short distance to the W. the

¹ Bristol Paper, p. 231.

uppermost S 2-beds are seen dipping at 60° W.S.W. Few better exposures of the Concretionary beds of S 2 are seen in the whole of the Bristol district. The sudden folding of the rocks at this point is accompanied by a local change of strike of a full right angle, a remarkable fact as no other signs of disturbance have been noted in the neighbourhood, and a short distance further W. at the Iron Plantation the normal strike is resumed.

In the field $\frac{1}{2}$ mile S.E. of Longwood House upper S 2-beds have been exposed in making golf-bunkers. Sixty Acre Plantation and the northern part of Ashton Hill Plantation are formed of S-beds. There are no quarries here, but many blocks are scattered about. The northern part of the Tyntesfield estate consists of S-beds, which are seen in the old quarry behind the building N. of the chapel, but there are no very satisfactory exposures to the E. of the tongue of Trias, which stretches northwards from Tyntesfield Farm. There are quarries in massive S 2 limestone with abundant *Lithostrotion martini* in the S.E. corner of the wood known as Sidelands and to the west of the Battleaxes, Wraxall. The *Seminula*-oolite, a compact white limestone is seen at various points near Parsonage Farm, and the exposures at the southern end of Wraxall Hill are in S 1, consisting of compact limestone with china-stone and *Seminula*-bands. In the neighbourhood of Wraxall Church another tongue of Trias extends northwards. To the W. of it near Ham Farm are several exposures of white oolite recognisable as the *Seminula*-oolite by the fossiliferous character. Underlying the oolite is a strong band of grit exposed in the fields to the W. of the lane crossing West Hill. There is a similar strong band of grit in S 1 in the Olveston area.¹ From Birdcombe Court a narrow band of S 1-beds extends westward to Tickenham Church. The best exposure is in a small quarry N. of Jacklands Bridge, where the red shaly partings between the limestone bands are crowded with *Diphyphyllum*, a coral which is found at the same level in the Avon Section. S 1-beds with china-stone bands and *Seminula* are seen at the southern end of Church Lane, Tickenham, and at various points westward from the church for a distance of 250 yards. No *Seminula*-beds are to be seen to the W. of this point. As Vaughan² points out, there is no room for the whole sequence between the S 1-beds of Tickenham Church and the Coal Measures of the neighbouring Nailsea Coal-field. There is no evidence to show whether the Coal Measures are faulted against the Carboniferous Limestone or rest on it unconformably. The former view is the more probable one, as the latter would involve post-*Seminula*-beds upheaval and erosion, of which there is no evidence elsewhere in the district.

¹ See Proc. B.N.S. 4th ser., Vol. IV (1914 issued for 1913), p. 101.

² Bristol Paper, p. 232.

(6) *The Dibunophyllum (D) Beds.*

These are only seen in the eastern part of the district, not being met with to the W. of Tyntesfield. In the Leigh Woods area there is a double development, a small northern wedge-shaped mass in the neighbourhood of Stoke Leigh Camp being formed by the D-beds in their normal position, while in the neighbourhood of Rownham Hill the same beds occur repeated by the Observatory Hill fault. The exposures in the railway cuttings by the Avon were briefly described with fossil lists by Vaughan.¹

Apart from the exposures in the Avon Valley, those of the wedge-shaped mass are poor and scanty. The best are in the crags which extend from the northern vallum of Stoke Leigh Camp down to the Avon. Here the various lithological types of the upper D₁ and lower D₂ beds may be easily recognised, particularly the coarse oolites, red grits, and bands full of *Productus*. Near the northern extremity of the wall which runs north eastwards from Beggar's Bush corner, the lower more massive limestones of D₁ are seen and contain the characteristic *Cyathophyllum murchisoni*. Apart from those in the Avon Valley the only exposure of D-beds as repeated by the fault, to be seen N. of Ashton Park is at the well-known quarry on Rownham Hill.² Much of the rock here is a coarse oolite. The southern boundary of the D-beds in Ashton Park is remarkably irregular, and we clearly have here a shore-line of Triassic age. The upper D-beds, which include much red grit form wooded promontories, with the Triassic rocks extending up the inlets between them. Church Wood must at one time have formed an island in the Triassic sea. The lower D₁-beds which as in the Avon Section contain little or no grit, and are often coarsely oolitic, are seen in an old quarry $\frac{1}{3}$ mile W. of Rownham Hill Lodge, and at a number of points on the hillside to the E. of New Barn. Many of the characteristic D₁ fossils may be readily found. Oolitic D₁ is also seen in a quarry in Clarken Combe. Ashton Hill and the neighbourhood of Providence, are mainly composed of red grit associated with red rubbly and often oolitic limestone. There are numerous exposures of both these rock-types, and in particular there is a considerable quarry in massive grey, coarsely crinoidal and foraminiferal limestone on Ashton Hill 300 yards W. of the Convalescent Home. To the W. of Providence Lane the surface is very irregular owing to the old shallow workings for iron ore, which appears to occur in bands interbedded with the limestone. The cutting which traverses Iron Plantation was doubtless made in search of ore. The material thrown out in making a series of bunkers for the Long Ashton Golf Club about $\frac{1}{4}$ mile W. of Iron Plantation enables the boundary between S and D to be very accurately fixed.

¹ Bristol Paper, pp. 197-199.

² Ibid, p. 197, and B.N.S. paper, p. 121.

D 1-beds, with the usual fossils, are exposed at a number of points in the northern part of Ashton Hill Plantation, while grits and limestones of D 2 age are seen at the south-eastern corner of George's Hill Plantation.

Two small patches of limestone are seen in the railway cutting to the east of the Fruit and Cider Institute, Long Ashton, and a tongue folded into a sharp anticline is traversed by the Great Western Railway by means of a cutting and short tunnel at Cambridge Batch $\frac{1}{2}$ mile E. of Flax Bourton Station. All these exposures are in D 1-beds as are the old quarries just N. of the railway at Cambridge Batch. These quarries form one of the best localities in the district for the examination of the D 1-beds, and were described by Vaughan.¹ The great width of the D outcrop here is probably due to a roll in the strata. The most westerly exposures of D-beds are seen in the south-eastern part of Tyntesfield grounds, but are neither good nor numerous.

V.—CONCLUSION.

The general lithological and faunal succession was determined by Vaughan, and although it is hoped that the proximity of the area to Bristol will justify the somewhat detailed account of the exposures given above, it cannot be claimed that many points of general interest have been established. The following seem worthy of mention :—

1. While the exposures are not sufficient to enable one to determine the thickness of the several bands with accuracy, the width of the outcrops indicates a progressive thickening of the strata as one passes westward.

2. The occurrence of a marked band of coarse oolite immediately underlying the Bryozoa Bed (K 1) at Abbot's Leigh and in the Failand and Charlton area is a feature known elsewhere in the Bristol district only in the Western Mendips (Burrington Combe).

3. The occurrence of strong grits in S 1 to the W. of Wraxall is a feature characteristic also of the development at Sodbury and Olveston in Gloucestershire.

Sincere thanks are tendered to the Hon. Mrs. Smyth for permission to visit exposures in the Ashton Court Estate, and to Lieut.-Col. G. C. Gibbs, M.P., for similar permission with regard to Tyntesfield.

¹ Bristol Paper, pp. 218-9.

Bristol Botany in 1915 and 1916.

By JAS. W. WHITE, F.L.S.

THE lengthy list that follows embraces a number of rare and attractive species. Of these no fewer than four are additions to the district flora. Together with those brought to light in 1914 these additions raise the number of plants (other than aliens) included in the *Flora of Bristol* to a total of 1184.

Ranunculus peltatus x *trichophyllus*. Excellent examples of this rare and remarkable hybrid (as I judge it) were obtained from a pond on Brimscombe Farm, between Chipping Sodbury and Wickwar. Besides the presumed parents no other water-buttercup was present. The *peltatus* plant is undoubtedly nearest that form of the aggregate usually referred to *R. floribundus* Bab.

Ranunculus sardous Crantz. (*R. hirsutus* Curtis). In *Rep. Watson Exch. Club*, 1914—1915, Mr. A. J. Wilmott comments on a contribution collected by Miss Roper in the mill-yard by Portishead Dock; and gives reasons for believing the specimens to belong to the closely allied *R. trilobus* Desf., an alien species from the Mediterranean region in which the carpels are tubercular all over both faces, not merely with a marginal ring of tubercles as in *R. sardous*. An examination of my own examples from Bristol rubbish-tips and waste ground reveals that some of them are really *R. trilobus*.

Helleborus viridis L. Miss Roper (*Journ. Bot.* LIII., p. 113) draws attention to a form of Green Hellebore, in which the sepals are blotched with purple at their base, that exists at Winterhead Farm, one of the Bristol stations for this plant. The only other known instance of the occurrence of a purple-spotted state appears to be one reported from Surrey by Mr. C. E. Salmon; and no mention of such a variation can be found in any botanical work.

H. fætidus L. New stations for the Stinking Hellebore are at Willis' Brake, near Ridgeway, Glouc.; and in Somerset on Wavering Down above Compton Bishop, *Dr. Wigglesworth*.

Viola odorata L. var. *præcox* Gregory. So early as the second week in January Miss Roper pointed this out to me on Tickenham Hill, S., whence a specimen forwarded to Mrs. Gregory was accepted by her "without hesitation."

Barbarea arcuata Rchb. Mention is made in *Fl. Brist.* of a peculiar form of Yellow Rocket, with spreading arcuate pods, gathered by the author many years ago in a marshy spot by Stapleton Bridge, G. This has now been identified as the *B. arcuata* of Reichenbach.

Sisymbrium officinale Scop. var. *leiocarpum* DC. Until lately known only with us as a rare casual on waste ground. But the two forms have been found growing together in quantity by a grassy track on Ivory Hill, G., where it was evident that the variety could be recognised at once by its paler and greener tint, the type being somewhat hoary and becoming purplish-brown at length.

Cerastium arvense L. Abundant in a rough, rocky pasture on the hillside near Axbridge, S. Discovered by Mr. H. S. Thompson. And Mrs. Reginald Price reports it from three spots on Lansdown, not far from the Grenville Monument. In this locality also the plant grows in natural turf.

Spergularia rubra Pers. Detected by Mr. Cedric Bucknall on a dry pennant bank near the G.W.R. north of Keynsham. New to North Somerset.

Medicago minima L. Sparingly casual at Newton St. Loe, S., Miss Roper.

Agrimonia odorata Mill. New to the Bristol district. This handsome plant has come out of its obscurity with a rush. In *Journ. Bot.* LIII., p. 280, Mr. H. S. Thompson reports having met with it in three different places in North Somerset. First, in company with the Rev. E. Ellman, near Charterhouse, on Mendip. Shortly afterwards Mr. Thompson came across a larger quantity on the edge of a field near Blackdown. Then, a little later, he found three clumps near Farrington Gurney. And Miss Roper has it from the Court Hill above Norton's Wood, Clevedon. For failure to recognise this plant earlier the only valid excuse lies, I take it, in the scanty descriptions in English books.

Potentilla argentea L. Discovered by the Rev. E. Ellman on a rocky limestone slope under the Cadbury ridge towards Clevedon. Extremely rare in Somerset.

Rubus incurvatus Bab. A new bramble. Gathered near Edington Junction, S., in the summer of 1914, by Mr. E. Metcalfe Day, of Minchinhampton, and named by the Rev. W. Moyle Rogers.

Dipsacus pilosus L. A number of fine specimens have appeared along a hedgerow near Clapton-in-Gordano, in a conspicuous position, where it had never before been noticed by the Misses Cundall who live in the neighbourhood.

Carthamus tinctorius L. Several plants on house-refuse tipped on the confines of Horfield, G., Mr. Ivor W. Evans. A handsome orange-flowered Composite, probably a native of Egypt and Abyssinia, and cultivated in many parts of the world for the colouring matter yielded by the flowers. According to old chroniclers this plant was formerly grown in Gloucestershire, both for the flowers and seed. The common people used

the flowers instead of saffron in their cakes and puddings, while geese and turkeys fed greedily upon the seed.

Carduus acaulis Willd., hybrid. Gathered in a rough pasture at Failand, North Somerset, by Miss Roper. The Rev. E. S. Marshall reports on this that allowing for differences of date and locality, and noting the intermediate foliage and short spines at the tip of many of the phyllaries, it comes very close to a plant found near Monmouth in 1903. Both are to be considered *C. acaulis* x *arvensis*; though not entirely without doubt, as the seeds of Miss Roper's plant appear to be well developed and hybrid thistles are very generally sterile.

Taraxacum palustre DC. Further localities for this interesting Dandelion are:—Barrow Hill, S., *Mrs. Sandwith*; Milbury Heath, G., and Rowberrow Warren, S., *Miss Roper*; and the Ridings near Chipping Sodbury, G., *C. Bucknall*.

Erythrœa pulchella Fries. Recorded from Leigh Woods by J. Poole in *New Bot. Guide Suppl.*, 1837, and not heard of afterwards until October, 1916. But it is still there in fair quantity on a broad mossy track.

Campanula patula L. We are indebted to Dr. J. Wiglesworth for a new locality. He reports this rare Bell-flower as fairly plentiful in the wood on Lyncomb Hill, S.

Rhinanthus major Ehrh. var. *platypterus* Fries. The aggregate species has been recorded twice or thrice, at intervals of years, as one of the rarest plants of the North Somerset peat moors, and is not known to us in any other region. The past summer must have been unusually favourable for it as the Rev. E. S. Marshall (*Journ. Bot.* LIV., p. 101) "came across it in profusion, towards the end of August, near Edington Junction; and also a little to the south of Shapwick Station but in smaller quantity. . . . All the specimens examined belonged to the var. *platypterus* Fries; they were glabrous with broad seed-wings. This confirmation of the old records is most satisfactory."

Centunculus minimus L. A most important addition to the local flora. The discovery had been anticipated (*Fl. Brist.* p. 36), but the actual detection of this beautiful little species was reserved for the Rev. E. Ellman, who found it in a position he wishes me to describe as "between Pill and Clifton Suspension Bridge, S."

Atriplex laciniata L. Has been observed very sparingly on the sandy shore near Berrow and (one plant) in Kewstoke Bay, by Mrs. Sandwith and Mr. C. Bucknall. The latter occurrence may well confirm another of Dr. St. Brody's statements in *Fl. Weston*.

Polygonum Raii Bab. On the shore near Berrow ; an extension of range noticed by the same botanists and at the same time as the last-mentioned species.

Rumex maximus Schreb. (*R. Hydrolapathum* var. *latifolius* Borrer.) Sparingly near Shirehampton, G., Miss Roper. And by the Avon near Saltford, S. ! C. Bucknall.

Daphne Mezereum L. The Mezereon still exists on Churchill Batch, whence it was believed to have been lost. Two plants have been found by Mr. T. H. Green. Eaker Hill Wood, Chewton Mendip, B. W. Tucker. Miss Roper has seen it there.

Viscum album L. The rarity of Mistletoe upon the Oak renders its occurrence in Leigh Woods, S., a matter of general interest. Miss Roper (*Journ. Bot.* LIV., p. 88) describes the presence of a large bunch near the top of a tree (*Quercus intermedia*) about 50 ft. in height and probably more than a century old.

Paris quadrifolia L. A new station, in a wood adjoining Beggar's Bush Lane, S., which, if the plant be lost from Leigh Woods, will be the nearest to Bristol, is supplied by Mr. Harold Robbins.

Galanthus nivalis, L. Large patches of snowdrops flower in a stretch of open woodland between Wraxall and Cadbury Camp, and there are some also in an adjoining orchard. The moss-covered remains of ancient buildings and enclosures seem to show that at a long past period the neighbouring farmstead had been a holding of greater importance than at present, provided probably with extensive shrubberies and gardens now lost and overgrown.

Juncus maritimus Lam. An old record for Portishead that has remained unconfirmed since its publication by Mr. S. Freeman in 1841, is now upheld by the Rev. E. Ellman, who has observed several clumps of this plant on the coast north of Portishead Pill.

J. tenuis Willd. This lately-discovered rush has been observed growing freely not only along the riverside under Leigh Woods, but about paths and tracks on the high ground in the interior of the wood. A few tufts in the valley leading up from one station to the other apparently form connecting links.

Potamogeton pusillus L. Miss Roper has detected this pondweed at Eastville Park in the lake, which is connected with the river Frome. This may be regarded, therefore, as a confirmation of Thwaites' old record in Swete's *Fl. Brist.* The station is the only one known in our Gloucestershire division.

Wolffia Michellii Schleid. (*W. arrhiza* Wimm.) The most interesting addition that has been made of late years to the flora

of North Somerset. Discovered June, 1915, in a peaty pool not far from Meare, S., by Mrs. Sandwith. And at the end of the following month in a pond near Brent Knoll Station, and in another towards Lympsham by the same lady in company with Mr. C. Bucknall. On August 5, Mrs. Sandwith found it again in a rhine between Catcott and Shapwick, quite hidden and covered by masses of duckweed. It shewed itself by adhering to the botanist's stick. In September the plant was found once more by Miss Roper in a pond and rhine by the railway between Middle Burnham. and Edith Mead.

Cyperus fuscus L. As stated in my paper for 1914 this sedge had not been seen in the Walton valley for a considerable time. In September last, however, a few plants of it rewarded a joint search made with several friends along some of the peaty ditches.

Eriophorum latifolium Hoppe. Is now known in three distinct spots on the western face of Blackdown.

Carex lasiocarpa (filiformis) x *riparia* = *C. evoluta* Hartm. This hybrid, which had not previously been seen in Britain, was observed by Mr. H. S. Thompson in July, towards the eastern end of the peat-moor between Edington and Street. Its distribution on the Continent and synonymy are fully described by the discoverer in *Journ. Bot.* LIII., p. 309.

C. hirta L. var. *spinosa* Mortensen. Gathered by Mr. H. S. Thompson at Charterhouse on Mendip, whence he kindly furnished me with an excellent specimen. It is a form with compound spikes and long spinescent glumes, that appears to have been ignored by most writers on the genus who possibly deem it of little importance.

Spartina Townsendii H. and J. Groves. The *Proceedings of the Bournemouth Nat. Science Society* contain instructive records of the spread of this grass along the tidal shores and inlets of Poole Harbour. These are the result of five years' labour by our former member, Mr. R. Vowell Sherring, F.L.S., who has long occupied himself with observations on the rapid and extensive progress of this grass. Many mud-flats have now become thickly covered and converted into meadows of succulent fodder, for which cattle have a great liking. We may anticipate a like change among the mud-flats of North Somerset, as the Rev. E. Ellman reports the interesting fact that he has seen the *Spartina* being planted (in 1913 to begin with) on the foreshore between Clevedon and Woodspring with the evident object of binding the mud and solidifying it against inroads of the tides.

Calamagrostis epigeios Roth. Highwood Lane, Over, G., F. Samson. Plentiful for many yards north of the old canal and railway between Meare and Shapwick Station, S. The specimens so closely resembled *C. lanceolata* in their loose, open panicles that it was only by dissecting flowers that determination became definite.

Festuca arundinacea Schreb. A first record for North Somerset is supplied by Miss Agnes Fry, who detected a clump of the true plant near Ladye Bay, Clevedon. Miss Roper reports it from another spot at a little distance from that first noticed.

Ceterach officinarum Willd. Bifid and trifid fronds, so frequent on plants of the allied genus *Scolopendrium*, are, in my experience, extremely rare with this fern. Miss Lee, of Bristol University, has lately discovered the variation on a wall at Kelston, S. She shewed also at a meeting of the Botanical Club good examples of the var. *crenatum* Milde.

Lycopodium Selago L. Discovered on Blackdown, Mendip, by Mrs. and Mr. N. Sandwith with Mr. T. H. Green. Three plants were seen at the beginning of May; but since that date I understand that many others have been noticed in several distinct patches.

ALIENS AND CASUALS.

From Portishead Dock and Station-yard; by Miss Livett. *Hypercium procumbens* L. *Bunias Erucago* L. *Trifolium nigrescens* Viv. *Phacelia congesta* Benth. *Gilia capitata* Sims. *Wiedmannia orientalis* F. and M. *Bromus scoparius* L.

From Portishead; by Miss Todd. *Festuca Broteri* Nym.

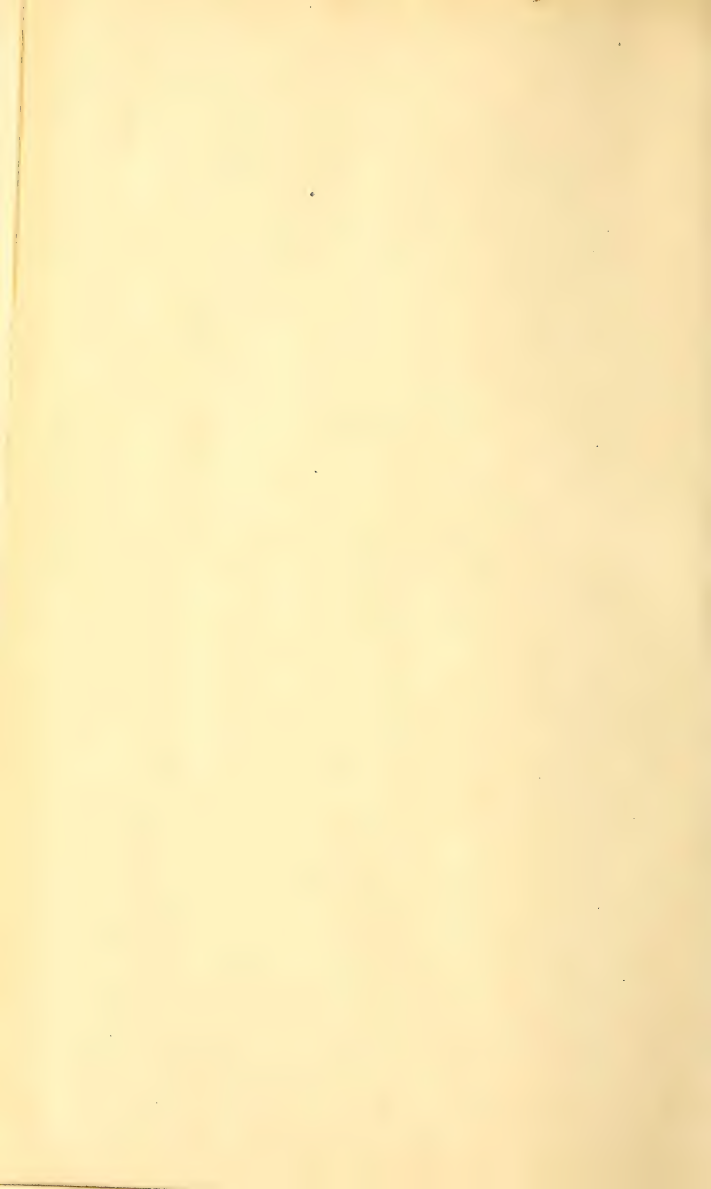
From Clevedon; by Miss Livett. *Senecio squalidus* L. var. *leiocarpus* Druce. *Echinosperrum Lappula* L.

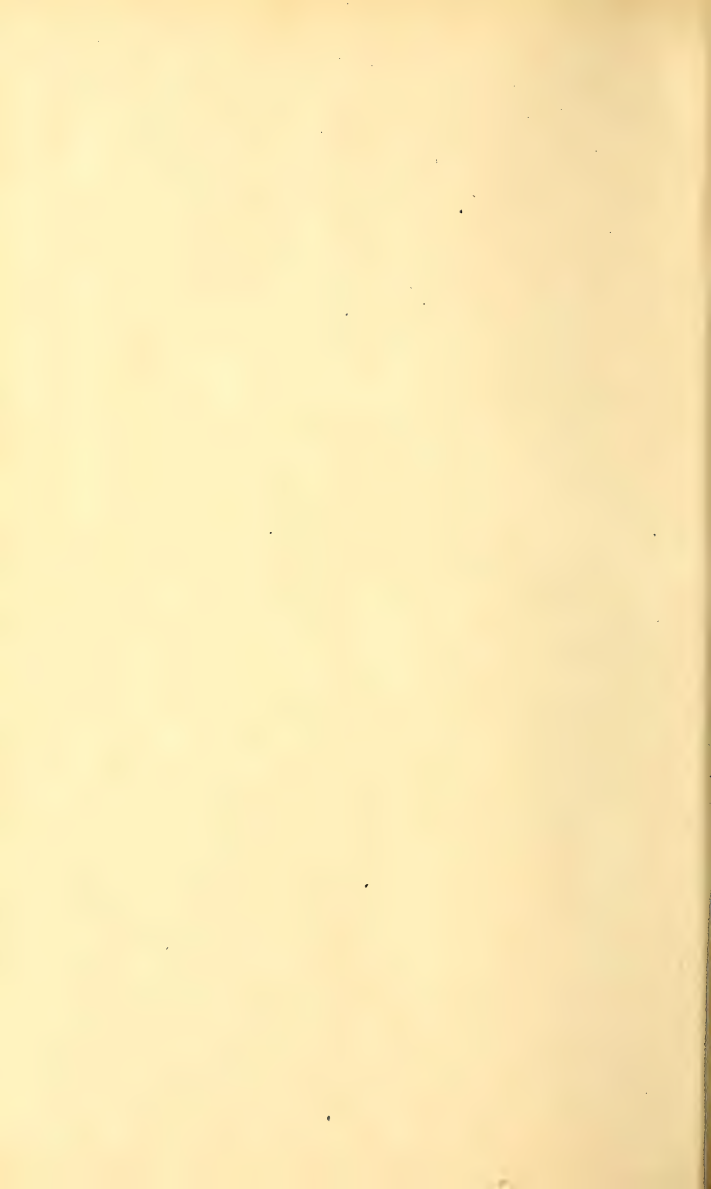
From waste heaps, Brislington; by Miss Roper. *Vicia striata* MB. = *V. purpurascens* DC. Agreeing well with my Hungarian specimens.

From Mangotsfield; by the author. *Bromus brachystachys* Hornung. An Asiatic species of marked characters, but of rare occurrence in this country. It has been naturalised for some years in Central Europe.

Alfred

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